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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1900.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1901.

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LETTER FROM THE VICE-PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES, SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE PAST YEAR, 1900.

National Academy of Sciences,
Washington, D. C., January 3, 1901.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

Asaph Hall,
Vice-President of the National Academy of Sciences.

The President of the Senate.

ACT OF INCORPORATION.

AN ACT to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Pierce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherfurd, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted,* That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT to amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882*.

True copies.

SEVELLON A. BROWN,
Chief Clerk.

AN ACT to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884*.

A true copy.

SEVELLON A. BROWN,
Chief Clerk.

REPORT

OF

THE NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1900 the Academy held three sessions. The first was the regular annual session held at Washington April 17 to 19, inclusive. The second was a scientific session held at Providence November 13 and 14. The third, a special session held at Providence November 14 for the transaction of business.

ANNUAL MEETING.

The session was held in the Columbian University, the President, Mr. Wolcott Gibbs, presiding.

The following members were present during the session: Abbe, Agassiz, Allen, Barus, Beecher, Billings, Boss, Brewer, Brooks, Brush, Chandler (S. C.), Chittenden, Comstock (C. B.), Dall, Dana, Dutton, Elkin, Emmons, Farlow, Gibbs (W.), Gilbert, Gill, Hague, Hall, Hill (G. W.), Langley, Mitchell (S. W.), Morse, Powell, Putnam, Remsen, Rowland, Schott, Walcott, Welch, White, Wilson.

REPORTS.

The President reported that no business from Congress or from the Departments had required the attention of the Academy since its meeting in April, 1899.

THE BARNARD MEDAL.

The President stated that he had appointed as committee on the Barnard medal:

J. S. Billings, chairman.
H. P. Bowditch.
Simon Newcomb.
Henry A. Rowland.
O. N. Rood.
Charles L. Jackson.
Seth C. Chandler.

INTERNATIONAL SCIENTIFIC ASSOCIATION.

The President said that, in accordance with the resolution passed by the Academy at the meeting in November last, he had notified the Royal Academy of Sciences in Berlin that the National Academy approved of the plan of organization of the International Association of Academies, adopted by the congress at Wiesbaden, and accepted membership therein. The following delegates were afterwards appointed to attend the meeting of the International Association in Paris during the summer of 1900:

H. L. Abbot.
J. M. Crafts.
A. G. Bell.

The President said that, in accordance with another resolution, passed by the Academy in November, he had referred the communication of the International Congress of Physicists to the President of the American Physical Society, Prof. Henry A. Rowland.

REPORT OF HOME SECRETARY.

During the past year the President's report for 1899 and the fourth memoir of Volume VIII have been printed; 160 copies of the report have been distributed, and nearly 900 copies of the memoir, 400 of which were sent to the authors.

Biographical memoirs of W. A. Rogers and J. P. Cooke have also been printed, but have not yet been distributed. These biographical memoirs are stored away by the printers until a sufficient number accumulates to make a volume.

A large number of packages, containing publications of learned societies, etc., have been received and stored unopened in the Smithsonian Building, as in former years.

REPORT OF THE FOREIGN SECRETARY.

The foreign secretary stated that the fifth Watson medal which had been awarded had been given to him with instructions to hand it to the British Ambassador for transmission to Mr. David Gill, at the Cape of Good Hope.

REPORT OF THE TREASURER.

Washington, D. C., *April 17, 1900*.

The President of the National Academy of Sciences.

Sir: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 17, 1900.

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	Smith fund.	Gould fund.	Emmons and Gill trustees.
Balance brought forward:							
Cash	$614.92	$2,707.50	$3,728.19	$2,010.92	$319.07	$890.61	....
Invested income	500.00	1,000.00	500.00	....	1,496.57	....	....
Interest	18.26	2,022.02	940.72	341.26	259.65	940.00	....
Members' tax	440.00	....	....	....	....	....	....
Appropriation returned	....	46.97	....	....	....	....	....
Emmons and Gill trustees	....	....	....	....	....	....	$245.00
Total	1,573.18	5,776.49	5,163.91	2,352.18	2,075.29	1,830.61	245.00
Disbursed	339.93	1,135.97	975.70	12.60	13.16	631.91	112.39
Balance:							
Cash	733.25	3,640.52	3,094.50	2,339.58	565.56	1,198.70	132.61
Invested	500.00	1,000.00	1,093.71	....	1,496.57	....	....
Total accounted for	1,573.18	5,776.49	5,163.91	2,352.18	2,075.29	1,830.61	245.00

Outstanding obligation, C. L. Doolittle (Gould fund), $200.

Chas. D. Walcott, *Treasurer*.

The report of the treasurer was referred to an auditing committee consisting of Messrs. Gill and Dall.

The committee appointed to examine the securities and papers found in the box of the National Academy of Sciences, safe deposit company, reported that they had examined the securities and papers, as described, and found them to correspond with these lists.

Theo. N. Gill, *Chairman*.
Wm. H. Dall.

The committee appointed to examine the report of the treasurer respectfully report that they have performed this duty, and they hereby certify that the statements of expenditures, receipts, and balances correspond to the vouchers and accounts of the treasurer and are found correct.

Theo. N. Gill, *Chairman*.
Wm. H. Dall.

RESIGNATION OF THE PRESIDENT.

Mr. Wolcott Gibbs read his resignation of the office of President of the Academy. This resignation was accepted with reluctance, to take effect at the close of the present session. The election of a President will be held at the next stated session, at Washington, in April, 1901.

REPORTS FROM TRUST FUNDS.

The Bache fund.

The President, as chairman of the trustees of this fund, reported the following appropriations since the meeting of the Academy in November, 1899:

1900.		
Apr. 5.	To Dr. H. C. Wood, for an investigation of the relation between the pulmonic and systemic circulation	$300
Apr. 10.	To Lewis Boss, for investigations on the standard stars	1,000
Apr. 11.	To Asaph Hall, jr., for investigations on the constant of aberration and the variation of latitude	250

The Watson fund.

(No report.)

The Draper fund.

(No report.)

The Smith fund.

(No report.)

The Gibbs Fund.

To the National Academy of Sciences.

GENTLEMEN: I have the honor to report that the income of the Wolcott Gibbs fund for research in chemistry was awarded to Dr. Wolcott Gibbs for use in his investigations.

Very respectfully,

C. L. JACKSON, *Chairman.*

The Gould fund.

The directors of the Benjamin Apthorp Gould fund desire respectfully to report the following grants of appropriations from the income of this fund:

To Herman S. Davis, in aid of the new reduction of Piazzi's observations	$500
To John A. Parkhurst, in aid of his investigations of variable stars	30

Respectfully submitted.

LEWIS BOSS,
S. C. CHANDLER,
ASAPH HALL,
Directors.

THE BARNARD MEDAL.

Dr. Wolcott Gibbs,
President National Academy of Sciences.

Dear Sir: The committee appointed by you to select one or more names of persons who are best entitled to receive the Barnard medal from Columbia University respectfully report that, after careful consideration of the subject, the name of Prof. Wilhelm Conrad Röntgen is presented as being that of the person who has within the five years beginning July 17, 1894, made the discovery which is most worthy of this honor, under the terms of the will of President Barnard.

Professer Röntgen announced his discovery of what he called the X-rays, now commonly known as Röntgen rays, in December, 1895. These rays exhibit many peculiar properties, and have been applied to various practical uses, the most important of which thus far have been in surgery. They are at the present time one of the most interesting and important subjects of research in physical science, and the discovery may be properly termed an epoch-making one.

In this recommendation the committee are unanimous.

J. S. Billings.
H. P. Bowditch.
S. C. Chandler.
H. A. Rowland.
O. N. Rood.
C. L. Jackson.
S. Newcomb.

List of recipients of medals awarded by the Academy.

THE DRAPER MEDAL.

Samuel P. Langley	1885
Edward C. Pickering	1887
Henry A. Rowland	1889
H. C. Vogel	1892
James E. Keeler	1899

THE WATSON MEDAL.

Benjamin A. Gould	1886
Edward Schönfeld	1888
Arthur Auwers	1890
Seth C. Chandler	1894
David Gill	1899

THE J. LAWRENCE SMITH MEDAL.

Hubert A. Newton	1888

THE BARNAND MEDAL.

Lord Rayleigh and Prof. William Ramsay	1895
Wilhelm Conrad Röntgen	1900

ELECTIONS.

Messrs. Billings, Bowditch, Brush, W. Gibbs, Hague, and Newcomb were elected members of the council.

Messrs. James E. Keeler, Henry F. Osborn, Samuel L. Penfield, and Franz Boas were elected members of the Academy.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

Secondary Enrichment of Sulphides in Ore Deposits. S. F. Emmons.

On the Zoogeographical Relationships of Africa. Theodore Gill.

The Cruise of the United States Fish Commission Steamer *Albatross* in South Seas, August, 1899, to March, 1900. A. Agassiz.

West Indian Madreporarian Polyps. J. E. Duerden; introduced by W. K. Brooks.

Report of the Watson Trustees on the award of the Watson Medal to Mr. David Gill. Simon Newcomb.

The Anatomy of *Nautilus pompilius*. L. E. Griffin; introduced by W. K. Brooks.

On the Use of Electric Motors of the Shunt Type for Solving Linear Differential Equations of any Order with Variable Coefficients. Reginald A. Fessenden; introduced by Cleveland Abbe.

On the Prediction of the Physical Properties of the Pure Metals. Reginald A. Fessenden; introduced by Cleveland Abbe.

A Partial Explanation of Some of the Principal Ocean Tides. Rollin A. Harris; introduced by Cleveland Abbe.

A Human Bone from the Glacial Deposit at Trenton, N. J. F. W. Putnam.

The Academy then adjourned to meet in Providence November 13.

SCIENTIFIC SESSION.

[Held in Providence November 13 and 14, 1900.]

A scientific session for the reading of papers having been called by the council, the Academy met at Brown University, Providence, the Vice-President, Mr. Asaph Hall, presiding.

The following members were present during the session: Abbe, Barus, Billings, Bowditch, Brush, Crafts, Farlow, Gill, Hague, Hall, Hyatt, Mendenhall, Michelson, Minot, Morse, Packard, Penfield, Remsen, Richards, Verrill, Walcott.

The following titles of papers were presented:

I. Investigations of Light and Electricity with the Aid of a Battery of Twenty Thousand Cells. J. Trowbridge.

II. Progressive Evolution of Characters in the Young Stages of Cephalopods. Alpheus Hyatt.

- III. Descriptive Method of Presenting the Phenomena of the Cycle of Evolution among Cephalopods. Alpheus Hyatt.
- IV. The Porous Cup Voltameter. T. W. Richards.
- V. An Account of the Study of Growing Crystals by Instantaneous Microphotography. T. W. Richards.
- VI. Stereographic Projection and Some of its Possibilities from a Graphical Standpoint. S. L. Penfield.
- VII. On the Development of the Pig. C. S. Minot.
- VIII. Normal Plates Illustrating the Development of the Rabbit and the Dogfish. C. S. Minot.
- IX. Note on the Energy of Recent Earthquakes. T. C. Mendenhall.
- X. Spectrum of Sodium in a Magnetic Field. A. A. Michelson.
- XI. A report of the Spectrum Work Carried on with the Aid of a Grant from the Bache Fund. H. A. Rowland.
- XII. On the Explanation of Inertia and Gravitation by Means of Electrical Phenomena. H. A. Rowland.
- XIII. Distribution of Philogeny of Limulus. A. S. Packard.
- XIV. Male Preponderance (Androrhopy) in Lepidopterous Insects. A. S. Packard.
- XV. The Synthesis and Reactions of Sodium Acetate Ester, and their Relation to a New Interpretation of Chemical Metathesis. A. Michael.
- XVI. On the Genesis of Matter. A. Michael.
- XVII. Demonstration of the Projection of One Grating by Another. C. Barus.
- XVIII. Exhibition of Certain Novel Apparatus; A Wave Machine; An Expansion Lens; A Recording System of Two Degrees of Freedom; A Tube Showing Colored Cloudy Condensation. C. Barus.
- XIX. On Stability of Vibration and on Vanishing Resonance. C. Barus.
- XX. Hysteresis-like Phenomena in Torsional Magnetostriction and Their Relation to Viscosity. C. Barus.
- XXI. Report on the Meeting of the Committee of the International Association of Academies. J. M. Crafts.
- XXII. Progress in the Echelon Spectroscope. A. A. Michelson.
- XXIII. Recent Observations of the Planet Eros. E. C. Pickering.
- XXIV. Screens free from Relative Absorption. E. C. Pickering.
- XXV. Folding and Faulting of Strata in Cordilleran Area. Charles D. Walcott.

BUSINESS MEETING OF THE ACADEMY.

[Providence, November 14, 1900.]

A business meeting of the Academy was called to consider the report of the Acting President to Congress and such other business as might be presented.

The Acting President read an outline of his report to Congress for the year 1900. The recommendation of the Council that the Acting President be authorized to include in his annual report to Congress the proceedings of the present meeting, as well as those of the meeting in Washington, April, 1900; and also any matters relating to Government business which may be submitted to the Academy prior to the presentation of his report, was approved.

REPORT OF J. M. CRAFTS,

Delegate of the Academy to the Meeting of the International Association of Academies.

I have not been able to obtain a report of the sittings of the committee representing the International Association of Academies, although it was understood that such a report would be promptly prepared, and I have written a month ago to M. Darboux to ask for a copy; but there were only two sittings of short duration, and little business was transacted, so that I can state to the Academy the principal features of the sessions.

It will be remembered that delegates from 9 academies met at Wiesbaden in October, 1899, upon the invitation of the Berlin Academy. The chief business at this meeting consisted in the establishment of a programme and the selection of 19 national academies which were invited to enter into an international association.

The Academy of Madrid has made no reply. Eighteen academies, sitting in the following capitals, gave in their adherence: Amsterdam, Berlin, Brussels, Budapest, Christiania, Copenhagen, Göttingen, Leipsic, London, Munich, Paris Academy of Sciences, Paris Academy of Inscriptions and Belles-Lettres, Paris Academy of Moral and Political Science, St. Petersburg, Rome, Stockholm, Vienna, Washington.

The letter of invitation had declared that other academies may be taken into the association by a vote of two-thirds of the academies which are associated.

The association comprises a literary and a scientific section, and each academy having these two sections may send two delegates to the meetings of the general committee. Twelve of the 18 are in this case; 4 have only a scientific section, and the 2 literary academies of Paris are only represented in their section.

It is expected that a general assembly will take place every three years, each academy sending any number of delegates, but having only one vote.

A meeting of an international committee will be held each year, with 16 scientific and 14 literary delegates. Rules of proceedings were adopted at Wiesbaden and accepted by the 18 academies which have joined the association. These rules can only be modified or extended by a two-thirds vote.

A very brief clause describes the objects of the association as being "to prepare and forward scientific work of general interest proposed by the academies and to facilitate international scientific relations."

It was under this constitution that a first meeting of the general committee was held in Paris, July 31, 1900, at the palace of the institute, M. Darboux, perpetual secretary of the Academy of Sciences, presiding under the rules, and Professor Diels, perpetual secretary of the Berlin Academy in the section of history and philosophy, was chosen vice-president and presided over the literary section. About twenty delegates were present.

It was understood that a general meeting would be held after that of the committee, and General Abbot, A. Graham Bell, and myself were appointed delegates. M. Darboux seems to have been informed that I was the delegate to the committee, our Academy having the right to send only one to its meeting. Unfortunately, as I think, the general meeting at which several delegates may take part was put off till April 16, 1901, in consequence of the desire expressed by a majority of the delegates to consult with their academies before that meeting.

I do not remember that questions of policy were brought up making such consultation necessary, and I should be interested to know whether communications upon such subjects have been received by the secretary.

The chief business done was the passage of rules that—

First. Each academy should pay the traveling expenses of its delegate, but without compulsion, which was interpreted only to mean that the international association should not pay them.

Second. The small expenses of printing and correspondence were to be paid by the academy (*Vorort*) which held the meeting.

Third. Each academy will print 300 copies of projects which it may wish to lay before the association; 100 to be sent to the academy under the auspices of which the meeting is held (Vorort).

Fourth. Each academy will subscribe to the committee annually a sum not exceeding $40.

The committee received a letter from a Belgian gentleman, M. Samson, asking if the association had the rights *persona juris* to receive donations. He was informed that a donation might be placed in the hands of any national academy for the use of the association.

Three projects of international scientific interest were presented and favorably received.

A proposal to facilitate the circulation of manuscripts and rare works.

A resolution in favor of the measurement of a long arc of a meridian in the southern hemisphere, which is, I believe, under consideration by the geodetic congress.

A proposal to express approval of the commission named at Cambridge, England, in August, 1898, to provide a better control of the physiological enregistering apparatus; also, to nominate additional members.

If the Academy will permit me to add my personal impressions to this brief report of business, I will say that by far the most interesting incident was the appearance before the committee of M. Marey to explain the needs of further control of physiological instruments. He gave a masterly exposition of the present conditions and the utility of the intervention of an international committee. It is to be supposed that the consideration of such subjects will in future be the chief duty of the international association.

In many cases subjects of general interest will be brought before the public with the authority of the united academies; in other cases some national academies will be selected to make representations to their respective governments in favor of some measure like a general geodetic survey.

Without doubt the most convenient rules of procedure will be best established by the form that the business gradually takes in the meetings of delegates; but it is true that they are sent as representatives of their academies, and many questions may arise where they would wish to receive instructions from the academies. For this reason I think it is to be regretted that a general assembly was not held this summer, giving opportunities to a large number of delegates to express opinions, to formulate rules of procedure, and to consult with the academies previous to their adoption in a subsequent meeting of the international association.

The most important point for consideration would appear to be the mode of studying and presenting general projects, either to governments or to the scientific public.

Care given to the mode of presentation is of great importance, and study by a small and competent committee should precede a vote; and it would seem advantageous to provide some means to enable the best authorities on a given subject to join with a committee of delegates to make a report to be adopted by the international association, with provision for publication.

Since making the above report proof sheets of minutes of the Paris meetings have been received from M. Darboux, on November 15.

The only important point which appears to be omitted in my report, made from memory, is the status before the committee of the amendments to rules proposed May 28, 1900, by our National Academy and of the Royal Society. This subject was not taken up in the two general meetings, but was considered by a special committee, of which your delegate was not a member, and consequently did not know its decision, which was as follows:

"*Resolved*, To refer to the next general meeting of the association the following amendments to Section X of the proposed statutes of the association:

"8. Such special committees shall consist of delegates appointed by the constituent academies with special reference to their qualification to deal with the questions under consideration.

"9. The first meeting of such a committee shall be called by the president of the international association or by the president of the council, and at this meeting each committee shall adopt rules for its own guidance.

"10. Each special committee shall make a report, embodying such recommendations as it may think advisable, to the president of the international council, who shall transmit the same to the constituent academies.

"11. The president of the council shall, however, have power, if he see fit, before transmitting such report to the constituent academies, to submit the same to the council, and this body shall have power to refer back the report to the committee for further consideration."

The Acting President announced the resignation of Mr. C. A. Young from the committee of the Henry Draper fund. Mr. E. C. Pickering was appointed a member of the committee in place of Mr. Young

The Acting President announced the deaths of Messrs. Fairman Rogers and James E. Keeler.

The members named below were appointed by the Acting President to prepare biographical memoirs as indicated in the table:

G. F. Barker, for Fairman Rogers.
C. S. Hastings, for James E. Keeler.
O. N. Rood, for F. A. P. Barnard.
Theodore Gill, for Elliott Coues.
S. C. Chandler, for B. A. Gould.
Arnold Hague, for O. C. Marsh.
C. A. Schott, for C. H. F. Peters.
J. S. Billings, for F. A. Walker.

Resolutions were adopted thanking the authorities of Brown University and of the University Club, of Providence, for their courtesies and hospitality.

The Academy adjourned.

APPENDICES.

APPENDIX A.

CONSTITUTION AND RULES OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may,

however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

SEC. 2. The officers of the Academy, together with six members to be elected by the Academy at the first stated session in each year, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

SEC. 3. The president of the Academy, or in case of his absence or inability to act the vice-president, shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The six additional members of the council shall be elected, on any day after the first of the first stated session in each year, by each voter inscribing six names on his ballot, and those six who have received more votes than any others shall be declared elected. If two or more names have received the lowest number of votes that would elect, additional balloting shall be had for as many members as remain each time to be elected until the number is full.

The term of the members so elected shall commence at the close of the session at which they are elected and continue until the close of the first stated session in the next year.

SEC. 4. Nominations of members may be made in writing, signed by any five members of the Academy, at any stated session, to be voted on at the next stated session held in Washington, and each nomination shall, at the time of election, be accompanied by a written list of the original works of the nominee.

SEC. 5. The Academy shall be divided into six standing committees. In this classification a member who is eminent in more than one subject may be assigned to a corresponding number of committees. The classification shall be the following:

1. Mathematics and Astronomy.
2. Physics and Engineering.
3. Chemistry.
4. Geology and Paleontology.
5. Biology.
6. Anthropology.

In nominating for membership in the Academy, a statement must be made as to the subject or subjects in which the person nominated is eminent. Every nomination must be submitted, through the secretary, to all the members of the committee or committees representing the

subject or subjects in which the person nominated is stated to be eminent; and in order that his name may be brought before the Academy for election he must receive the votes of a majority of the members of the committee or committees to which his name has been referred.

Elections for membership shall be held in the following manner: Each member may inscribe on a ballot not more than five names of nominees selected from the list. Absent members may send such ballots to the home secretary. From the seven names receiving the highest number of votes in this preference ballot the members present may proceed to elect new members in the following manner: At each ballot each member present may vote for not exceeding three persons, and the person receiving the highest number of votes shall be declared elected, provided that he receive two-thirds of the votes cast and that his name appear on not less than twenty ballots; and provided further, that the number of members of the Academy be not already one hundred or over, in which case to be declared to be elected he must receive four-fifths of the votes cast, and his name must appear on at least twenty-five ballots.

Should several candidates have the same minimum number of votes on the preference list, the requisite number for completing the list shall be selected from them by a two-thirds vote of the members present.

Election of members shall be held only at the regular stated session of each year held in Washington, and not more than five members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. Foreign associates may be nominated by a committee of five members, to be appointed for that purpose by the president and elected at any stated session by a two-thirds vote of the members present. The election shall be had by each member indicating on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the ballots shall be declared elected.

SEC. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the Academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

SEC. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council, and afterwards to the Academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy, upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with

the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

SEC. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy at the same session. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.

7. Other business.

8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of Departments of the Govern-

ment, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1901.

	Expiration of term.
———, ———	—— ——
Hall, Asaph, *Vice-President*	April, 1903.
Agassiz, A., *Foreign Secretary*	April, 1901.
Remsen, Ira, *Home Secretary*	April, 1903.
Walcott, Charles D., *Treasurer*	April, 1904.

ADDITIONAL MEMBERS OF COUNCIL, 1901.

Billings, J. S.
Bowditch, H. P.
Brush, G. J.
Gibbs, W.
Hague, A.
Newcomb, S.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
    - Abbe, C.
    - Boss, L.
    - Chandler, S. C.
    - Comstock, G. C.
    - Davidson, G.
    - Elkin, W. L.
    - Hall, A.
    - Hill, G. W.
    - Holden, E. S.
    - Newcomb, S.
    - Peirce, C. S.
    - Pickering, E. C.
    - Woodward, R. S.
    - Young, C. A.
2. Physics and Engineering.
    - Abbe, C.
    - Abbot, H. L.
    - Barker, G. F.
    - Barus, C.
    - Bell, A. G.
    - Comstock, C. B.
    - Gibbs, J. W.
    - Hastings, C. S.
    - Langley, S. P.
    - Mendenhall, T. C.
    - Michelson, A. A.
    - Mitchell, H.
    - Morley, E. W.
    - Morton, H.
    - Pickering, E. C.

2. Physics and Engineering—Continued.
    - Rood, O. N.
    - Rowland, H. A.
    - Schott, C. A.
    - Sellers, W.
    - Trowbridge, J.
    - Woodward, R. S.
    - Wright, A. W.
3. Chemistry.
    - Barker, G. F.
    - Brush, G. J.
    - Chandler, C. F.
    - Chittenden, R. H.
    - Crafts, J. M.
    - Dana, E. S.
    - Gibbs, W.
    - Gooch, F. A.
    - Hilgard, E. W.
    - Hill, H. B.
    - Jackson, C. L.
    - Johnson, S. W.
    - Michael, A.
    - Morley, E. W.
    - Penfield, S. L.
    - Remsen, I.
    - Richards, T. W.
    - Smith, E. F.
4. Geology and Paleontology.
    - Beecher, C. E.
    - Dall, W. H.
    - Dutton, C. E.

On nominations of new members—Continued.

4. Geology and Paleontology—Cont'd.
    - Emmons, S. F.
    - Gilbert, G. K.
    - Hague, A.
    - King, C.
    - Le Conte, J.
    - Leslie, J. P.
    - Osborn, H. F.
    - Pumpelly, R.
    - Walcott, C. D.
    - White, C. A.
5. Biology.
    - Agassiz, A.
    - Allen, J. A.
    - Bowditch, H. P.
    - Brewer, W. H.
    - Brooks, W. K.
    - Chittenden, R. H.
    - Dall, W. H.
    - Farlow, W. G.
    - Gill, T. N.
    - Goodale, G. L.
    - Hyatt, A.
    - Minot, C. S.
    - Morse, E. S.

5. Biology—Continued.
    - Osborn, H. F.
    - Packard, A. S.
    - Putnam, F. W.
    - Sargent, C. S.
    - Scudder, S. H.
    - Smith, S. I.
    - Verrill, A. E.
    - Walcott, C. D.
    - Welch, W. H.
    - White, C. A.
    - Whitman, C. O.
    - Wilson, E. B.
    - Wood, H. C.
6. Anthropology.
    - Billings, J. S.
    - Boas, F.
    - Mayo-Smith, R.
    - Minot, C. S.
    - Mitchell, S. W.
    - Morse, E. S.
    - Powell, J. W.
    - Putnam, F. W.
    - Welch, W. H.

On Weights, Measures, and Coinage.

Mendenhall, T. C.
Newcomb, S.
Michelson, A. A.
Peirce, C. S.
Young, C. A.

On the Election of Foreign Associates.

Agassiz, A., *Chairman.*
Mitchell, S. W.
Hall, A.
Newcomb, S.

On Publications of the Academy.

Gill, T. N.

TRUST FUNDS.

Board of Direction of the Bache Fund.

Gibbs, Wolcott.
Chandler, S. C.
Scudder, S. H.

Board of Trustees of the Watson Fund.

Newcomb, S., *Chairman.*
Hall, A.
Boss, L.

The Henry Draper Fund.

Pickering, E. C., *Chairman.*
Trowbridge, J.
Newcomb, S.
Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

Brush, G. J., *Chairman.*
Johnson, S. W.
Morley, E. W.
Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

Hall, Asaph.
Chandler, S. C.
Boss, Lewis.

The Barnard Medal.

Billings, J. S., *Chairman.*
Bowditch, H. P.
Chandler, S. C.
Rowland, H. A.
Rood, O. N.
Jackson, C. L.
Newcomb, S.

The Wolcott Gibbs Fund.

Jackson, C. L.
Remsen, Ira.
Drown, T. M.

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, JANUARY 1, 1901.

		Date of election.
Abbe, Cleveland	*2017 I st NW., Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*Army Building, New York City.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum, New York City.*	1876
Barker, George F	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Providence, R. I.*	1892
Beecher, Charles E	*New Haven, Conn.*	1899
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Boss, Lewis	*Albany, N. Y.*	1889
Bowditch, Henry P	*Jamaica Plain, Mass.*	1887
Brewer, William H	*418 Orange st., New Haven, Conn.*	1880
Brooks, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
Brush, George J	*14 Trumbull st., New Haven, Conn.*	1868
Chandler, Charles F	*New York City.*	1874
Chandler, Seth C	*16 Craigie st., Cambridge, Mass.*	1888
Chittenden, Russell H	*New Haven, Conn.*	1890
Comstock, Cyrus B., U. S. A	*34 W. Twenty-fifth st., New York City.*	1884
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Crafts, James M	*59 Marlboro st., Boston, Mass.*	1872
Dall, William H	*Washington, D. C.*	1897
Dana, Edward S	*New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Dutton, Clarence E., U. S. A	*Ordnance Office, War Dep't, Washington, D. C.*	1884
Elkin, William L	*New Haven, Conn.*	1895
Emmons, Samuel F	*Washington, D. C.*	1892
Farlow, W. G	*Cambridge, Mass.*	1879
Gibbs, Josiah Willard	*New Haven, Conn.*	1879
Gibbs, Wolcott	*Newport, R. I.*	——
Gilbert, Grove K	*Washington, D. C.*	1883
Gill, Theodore N	*Washington, D. C.*	1873
Gooch, Frank A	*New Haven, Conn.*	1897
Goodale, George L	*Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885

		Date of election.
Hall, Asaph	*12 Kirkland place, Cambridge, Mass.*	1875
Hastings, Charles S	*New Haven, Conn.*	1889
Hilgard, Eugene W	*Berkeley, Cal.*	1872
Hill, George W	*West Nyack, N. Y.*	1874
Hill, Henry B	*Cambridge, Mass.*	1883
Holden, Edward S	*Century Club, New York City.*	1885
Hyatt, Alpheus	*234 Berkeley st., Boston, Mass.*	1875
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
Johnson, Samuel W	*54 Trumbull st., New Haven, Conn.*	1866
King, Clarence	*Century Club, New York City.*	1876
Langley, Samuel P	*Washington, D. C.*	1876
Le Conte, Joseph	*Berkeley, Cal.*	1875
Lesley, J. Peter	*711 Walnut st., Philadelphia, Pa.*	——
Mayo-Smith, Richmond	*305 W. Seventy-seventh st., New York City.*	1890
Mendenhall, Thomas C	*Worcester, Mass.*	1887
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A	*Chicago, Ill.*	1888
Minot, Charles S	*Boston, Mass.*	1897
Mitchell, Henry	*Nantucket, Mass.*	1885
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Morley, Edward W	*Adelbert College, Cleveland, Ohio.*	1897
Morse, Edward S	*P. O. Box 268, Salem, Mass.*	1876
Morton, Henry	*Hoboken, N. J.*	1874
Newcomb, Simon, U. S. N.	*1620 P st. NW., Washington, D. C.*	1869
Osborn, H. F	*New York City.*	1900
Packard, A. S.	*Providence, R. I.*	1872
Peirce, Charles S.	*Milford, Pa.*	1876
Penfield, S. L	*New Haven, Conn.*	1900
Pickering, Edward C	*Cambridge, Mass.*	1873
Powell, John W	*Washington, D. C.*	1880
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Putnam, Frederick W	*Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W	*Cambridge, Mass.*	1899
Rood, Ogden N	*New York City.*	1865
Rowland, Henry A	*Johns Hopkins University, Baltimore, Md.*	1881
Sargent, Charles S	*Jamaica Plain, Mass.*	1895
Schott, Charles A	*212 First st. SE., Washington, D. C.*	1872
Scudder, Samuel H	*Cambridge, Mass.*	1877
Sellers, William	*1600 Hamilton st., Philadelphia, Pa.*	1873
Smith, Edgar F	*Philadelphia, Pa.*	1899
Smith, Sidney I	*New Haven, Conn.*	1884
Trowbridge, John	*Cambridge, Mass.*	1878
Verrill, A. E	*New Haven, Conn.*	1872
Walcott, Charles D	*Washington, D. C.*	1896
Welch, William H	*935 St. Paul st., Baltimore, Md.*	1895
White, Charles A	*330 T st. NW., Washington, D. C.*	1889
Whitman, Charles O	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B	*Columbia University, New York City.*	1899
Wood, Horatio C	*1925 Chestnut st., Philadelphia, Pa.*	1879
Woodward, Robert S	*Columbia University, New York City.*	1896
Wright, Arthur W	*New Haven, Conn.*	1881
Young, Charles A	*Princeton, N. J.*	1872

DECEASED MEMBERS.

	Date of death
*Agassiz, Louis	Dec. 14, 1873
*Alexander, J. H	Mar. 2, 1867
*Alexander, Stephen	June 25, 1883
*Bache, Alexander Dallas	Feb. 14, 1867
*Baird, Spencer F	Aug. 19, 1887
Barnard, F. A. P	Apr. 27, 1889
Barnard, J. G	May 14, 1882
Bartlett, W. H. C	Feb. 11, 1893
*Brown-Sequard, Charles E	Apr. 2, 1894
*Casey, Thomas L., U. S. A	Mar. 25, 1896
*Caswell, Alexis	Jan. 8, 1887
*Chauvenet, William	Dec. 13, 1870
*Clarke, Henry James	July 1, 1873
*Coffin, James H	Jan. 6, 1873
*Coffin, J. H. C	Jan. 8, 1890
*Cook, George H	Sept. 22, 1889
*Cooke, Josiah P.	Sept. 3, 1894
*Cope, Edward D	Apr. 12, 1897
Coues, Elliott	Dec. 25, 1899
Dalton, J. C	Feb. 2, 1889
Dana, James D	Apr. 14, 1895
*Davis, Charles H	Feb. 18, 1877
*Draper, Henry	Nov. 20, 1882
*Draper, John W	Jan. 4, 1882
*Eads, James B	Mar. 8, 1887
*Engelman, George	Feb. 4, 1884
*Ferrel, William	Sept. 18, 1891
*Frazer, John Fries	Oct. 12, 1872
*Gabb, William M	May 30, 1878
Genth, F. A	Feb. 2, 1893
*Gilliss, James Melville	Feb. 9, 1865
*Goode, G. Brown	Sept. 6, 1896
*Gould, Augustus A	Sept. 15, 1866
Gould, Benjamin A	Nov. 27, 1896
*Gray, Asa	Jan. 30, 1888
*Guyot, Arnold	Feb. 8, 1884
*Hadley, James	Aug. 1, 1864
*Haldeman, S. S	Sept. 20, 1880
Hall, James	Aug. 8, 1898
*Hayden, F. V	Dec. 22, 1887
*Henry, Joseph	May 13, 1878
*Hilgard, Julius E	May 8, 1891
*Hitchcock, Edward	Feb. 27, 1864
*Holbrook, J. E	Sept. 8, 1871
*Hubbard, J. S	Aug. 16, 1863
*Humphries, A. A	Nov. 28, 1883
Hunt, T. Sterry	Feb. 12, 1892
Keeler, J. E	Aug. 12, 1900
*Kirkland, Jared P	Dec. 10, 1877

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* Biographical notices have been presented of those designated by an asterisk.

	Date of death.
* LANE, J. HOMER	May 3, 1880
* LE CONTE, JOHN	Apr. 29, 1891
* LE CONTE, JOHN L	Nov. 15, 1883
LEA, MATTHEW C	Mar. 15, 1897
LEIDY, JOSEPH	Apr. 30, 1891
* LESQUEREUX, LEO	Oct. 25, 1889
LONGSTRETH, MIERS F	Dec. 27, 1891
* LOOMIS, ELIAS	Aug. 16, 1889
LOVERING, JOSEPH	Jan. 18, 1892
LYMAN, THEODORE	Sept. 10, 1897
* MAHAN, D. H	Sept. 16, 1871
* MARSH, G. P	July 23, 1882
MARSH, O. C	Mar. 18, 1899
MAYER, ALFRED M	July 13, 1897
* MEEK, F. B	Dec. 21, 1877
* MEIGS, M. C	Jan. 2, 1892
* MORGAN, LEWIS H	Dec. 14, 1881
NEWBERRY, J. S	Dec. 7, 1892
* NEWTON, H. A	Aug. 1, 1896
NEWTON, JOHN	May 1, 1895
* NORTON, WILLIAM A	Sept. 21, 1883
* OLIVER, JAMES E	Mar. 27, 1895
PETERS, C. H. F	July 18, 1890
* POURTALES, L. F	July 19, 1880
RODGERS, JOHN	May 5, 1882
ROGERS, FAIRMAN	Aug. 23, 1900
ROGERS, ROBERT E	Sept. 7, 1884
* ROGERS, WM. A	Mar. 1, 1898
* ROGERS, WILLIAM B	May 30, 1882
* RUTHERFORD, LEWIS M	May 30, 1892
* SAXTON, JOSEPH	Oct. 26, 1873
* SILLIMAN, BENJ., Sr	Nov. 24, 1864
SILLIMAN, BENJ., Jr	Jan. 14, 1885
* SMITH, J. LAWRENCE	Oct. 12, 1883
* STIMPSON, WILLIAM	May 26, 1873
* STRONG, THEODORE	Feb. 1, 1869
* SULLIVANT, W. S	Apr. 30, 1873
* TORREY, JOHN	Mar. 10, 1873
* TOTTEN, J. G	Apr. 22, 1864
* TROWBRIDGE, WILLIAM P	Aug. 12, 1892
TRUMBULL, JAMES H	Aug. 5, 1897
* TUCKERMAN, EDWARD	Mar. 15, 1886
WALKER, FRANCIS A	Jan. 5, 1897
* WARREN, G. K	Aug. 8, 1882
* WATSON, JAMES C	Nov. 23, 1880
* WATSON, SERENO	Mar. 9, 1892
* WINLOCK, JOSEPH	June 11, 1875
* WOODWARD, J. J., U. S. A	Aug. 17, 1884
* WORTHEN, A. H	May 6, 1888
* WYMAN, JEFFRIES	Sept. 4, 1874

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* Biographical notices have been presented of those designated by an asterisk.

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FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Baeyer, Adolph (Ritter von)	*Munich.*
Berthelot, M. P. E	*Paris.*
Gegenbaur, Karl	*Heidelberg.*
Gill, David	*Cape Town.*
Hooker, Sir J. D.	*Kew.*
Kelvin (Lord)	*Glasgow.*
Klein, Felix	*Göttingen.*
Kölliker, Albert von	*Würzburg.*
Lacaze-Duthiers, Henri de	*Paris.*
Lister (Lord)	*London.*
Moissan, Henri	*Paris.*
Poincaré, Henri	*Paris.*
Rayleigh (Lord)	*London.*
Richthofen, F. von	*Berlin.*
Stokes, Sir George G	*Cambridge.*
Strasburger, Edouard	*Bonn.*
Struve, Otto von	*Karlsruhe.*
Suess, Edouard	*Vienna.*
Virchow, Rudolph von	*Berlin.*
Zittel, Karl Alfred (Ritter von)	*Munich.*

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.
C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.
Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekulé.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1901.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1901.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE PAST YEAR, 1901.

NATIONAL ACADEMY OF SCIENCES,
Washington, D. C., January 10, 1902.

SIR: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

A. AGASSIZ,
President of the National Academy of Sciences.

The PRESIDENT OF THE SENATE.

ACT OF INCORPORATION.

AN ACT to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Pierce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherfurd, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared o be a body corporate, by the name of the National Academy of Sciences.

Sec. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and he said corporation hereby constituted shall have power to make its wn organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT to amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882.*

True copies.

SEVELLON A. BROWN,
Chief Clerk.

AN ACT to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN,
Chief Clerk.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1901 the Academy held three sessions: The first, the regular annual session, held at Washington April 16 to 18, inclusive; the second, a scientific session, held at Philadelphia November 12 to 14; the third, a special session, held at Philadelphia November 13 and 14, for the transaction of business.

ANNUAL MEETING.

The session was held at the U. S. National Museum, Washington, April 16, 17, and 18, the acting president, Mr. Asaph Hall, presiding.

The following members were present during the session: Messrs. Abbe, Abbot, Agassiz, Allen, Barus, Beecher, Bell, Billings, Boas, Boss, Bowditch, Brewer, Brooks, Brush, Chandler (S. C.), Chittenden, Dall, Emmons, Farlow, Gilbert, Gill, Hague, Hall, Hill (G. W.), Hyatt, King, Langley, Mendenhall, Michelson, Minot, Morley, Morse, Newcomb, Osborn, Penfield, Powell, Putnam, Remsen, Walcott, Welch, Wilson, and Woodward.

REPORTS.

The acting president made the following report:

Since the meeting of the Academy in November the following appointments have been made:

Mr. E. C. Pickering was appointed chairman of the trustees of the Henry Draper fund in place of Mr. G. F. Barker, resigned, and Mr. A. A. Michelson, a trustee of this fund, in place of Mr. C. A. Young, resigned.

Mr. E. W. Morley was appointed a member of the board of trustees of the J. Lawrence Smith fund in place of Mr. A. Hall, resigned.

Some difficulty was found in the appointment of a delegate to attend the meeting of the International Association of Academies to be held in Paris, April 16. Mr. George L. Goodale was appointed a delegate to attend the meeting if his health would permit.

Messrs. William G. Farlow and Theodore N. Gill were appointed delegates to attend the celebration of the four hundred and fiftieth anniversary of the foundation of the University of Glasgow on June 15, 1901.

The Academy has had no Government business to transact during the past year.

The home secretary reported as follows:

During the past year the report of the acting president for 1900 has been printed and distributed to members of the Academy and a few libraries in this country.

The fifth memoir of Volume VIII has been printed.

The Treasurer presented his report for the year, as follows:

REPORT OF THE TREASURER.

WASHINGTON, D. C., *April 16, 1901.*

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 16, 1901.

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	Smith fund.	Gould fund.	Emmons and Gill trustees.
Balance brought forward:							
Cash	$733.25	$3,640.52	$3,094.50	$2,339.58	$565.56	$1,198.70	$132.61
Invested income	500.00	1,000.00	1,093.71	....	1,496.57	....	....
Interest	35.38	2,126.32	1,015.64	334.41	372.36	965.00	....
Members' tax	425.00	....	....	....	....	....	....
Appropriation returned	....	150.00	....	....	....	....	....
Subscription to building fund.	100.00	....	....	....	....	....	....
Emmons and Gill trustees	....	....	....	....	....	....	255.00
Total	1,793.63	6,916.84	5,203.85	2,673.99	2,434.49	2,163.70	387.61
Disbursed	282.51	2,750.58	423.84	1,012.60	763.16	1,011.91	47.13
Balance:							
Cash	1,011.12	1,166.26	1,786.30	1,660.39	174.76	1,151.79	340.48
Invested	500.00	3,000.00	2,993.71	....	1,196.57	....	....
Total accounted for	1,793.63	6,916.84	5,203.85	2,673.99	2,434.49	2,163.70	387.61

Outstanding obligations, Lewis Boss (Bache fund), $1,000.

Very respectfully,

CHAS. D. WALCOTT, *Treasurer.*

The treasurer's report was referred to an auditing committee consisting of Messrs. Abbot, Minot, and Penfield, who, after due examination, reported as follows:

APRIL 16, 1901.

The committee appointed to examine the report of the treasurer respectfully report that they have performed this duty, and they hereby certify that the statements of expenditures, receipts, and balances correspond to the vouchers and accounts of the treasurer and are found correct.

HENRY L. ABBOT.
CHARLES S. MINOT.
SAMUEL L. PENFIELD.

The committee consisting of Messrs. Schott, Emmons, and Dall, appointed to examine the securities and papers found in the box of the National Academy of Sciences at the American Security and Trust Company's building, reported that they had examined the securities and papers, as described, and found them to correspond with the list furnished by the treasurer.

THE DRAPER MEDAL.

The home secretary read a report from the committee on the Henry Draper fund recommending the award of the Henry Draper medal to Sir William Huggins for his investigations in astronomical physics.

CAMBRIDGE, MASS., *April 3, 1901.*

DEAR SIR: The Henry Draper committee met in New York on January 29, 1901, and voted unanimously to recommend to the Academy that the Henry Draper medal be awarded to Sir William Huggins for his investigations in astronomical physics. A statement of the reasons for this recommendation is enclosed herewith. The accumulated income of the fund on April 17, 1900, amounted to $2,339.58.

The deed of gift of Mrs. Draper provides that the accumulated income shall be used "in aid of investigation and work in astronomical physics to be made and carried on by a citizen or citizens of the United States of America." Accordingly, it was voted to appropriate the sum of $500 to Prof. W. W. Campbell for the construction of a one-prism spectograph for use with the 36-inch reflecting telescope now building for the Lick Observatory. It was also voted that an appropriation of $500 be made to Prof. George E. Hale, to be applied toward the construction of a horizontal coelostal reflecting telescope of 24 inches aperture and 200 feet focal length, for the Yerkes Observatory.

In order to carry out the terms of the deed of gift, it is proposed to make further appropriations from the income as suitable objects present themselves.

Respectfully submitted.

EDWARD C. PICKERING, *Chairman.*
A. A. MICHELSON.
SIMON NEWCOMB.
ARTHUR W. WRIGHT.
JOHN TROWBRIDGE.

Prof. ASAPH HALL,
Acting President, National Academy of Sciences.

INVESTIGATIONS IN ASTRONOMICAL PHYSICS BY SIR WILLIAM HUGGINS.

It is not an easy matter to concentrate into a few pages the results attained by an active worker during a period of nearly half a century. Fortunately, in the present case, this labor has been greatly simplified by the recent publication, by Sir William and Lady Huggins, of an Atlas of Representative Spectra from wave length 4,870 to 3,300, together with a discussion of the evolutional order of the stars, and the interpretation of their spectra, preceded by a short history of the Observatory and its work. This monumental volume not only furnishes a statement of the various publications of the authors, but exhibits the relation of the various investigations undertaken much better than could readily be done by another. From this it appears that the work began in 1856 with a 5-inch Dolland equatorial, which was replaced two years later by an excellent 8-inch Clark telescope. In 1870 this was again replaced by a 15-inch achromatic and an 18-inch reflector. In 1858 Sir William, then Mr. Huggins, undertook with Dr. Miller the visual study of stellar spectra. This work was continued until 1864, and the results were communicated to the Royal Society. Soon after this, on August 29, 1864, Sir William made one of the great discoveries in astrophysics. He found that the spectrum of the planetary nebula in Draco, N. G. C. 6543, had a monochromatic spectrum.

It has heretofore been supposed that all nebulæ might consist of distant stars and could be resolved into their components by a telescope of sufficient power. This theory was at once disposed of, and it appeared that of 60 of the brighter nebulæ and clusters about one-third were of this gaseous character. In 1866 the observations of the new star in Corona gave the first clew to the cause of these remarkable objects. In 1868 Sir William was able to announce the first step in an investigation which in recent years has become one of the most important in astrophysics. The hydrogen lines in the brightest stars showed a slight displacement, from which the motion of these bodies in the line of sight may be determined. The accurate measurement of this quantity is now occupying a large part of the time of the greatest telescopes in the world. It is leading to unexpected results, which throw important light on the formation of the universe. The fact that these displacements are wholly independent of the distance of the source of light gives an opportunity to study problems for which ordinary visual methods fail entirely. About this time, also, a study of comets showed that their spectra closely resembled that of olefiant gas. A proposal of great scientific importance was a method of observing the solar protuberances in the uneclipsed sun. This method was devised independently by Mr. Lockyer. It is now claimed that these remarkable phenomena can be better seen any clear day at a fixed observatory than with portable instruments during a total solar eclipse. In 1876 the study of the spectra of the stars by means of photography, which had been attempted without attaining satisfactory results in 1863, was undertaken. Among the results published four years later, one of the most important was the discovery of the wonderful series of lines due to hydrogen. Similar series of lines are now found to exist in the spectra of many other terrestrial elements, and form the basis of the spectroscopic relation of these substances with one another.

During the last quarter of a century Sir William and Lady Huggins have worked together in developing this most powerful method of research. Applying it to one object after another, a theory of the universe has been evolved, which is described in full in the work mentioned above. It is probable that this method must, in general, be followed in all attempts to study the chemical relation of stars to one another.

We thus see that Sir William Huggins's activity has extended over nearly half a century. During this time discoveries of the greatest importance have been made, on which advances in astrophysics largely depend. Besides this, laborious investigations have been undertaken, extending over many years, by which the methods discovered have been developed and applied. For this remarkable record of scientific activity and perseverance the undersigned recommend the award by the Academy of the Henry Draper medal to Sir William Huggins.

Respectfully submitted.

EDWARD C. PICKERING, *Chairman.*
A. A. MICHELSON.
S. NEWCOMB.
ARTHUR W. WRIGHT.
JOHN TROWBRIDGE.

Later the following letter was received from Sir William Huggins:

90, UPPER TULSE HILL, S. W., *April 16, 1901.*

DEAR SIR: I have the honor to acknowledge your letter of the 2d instant, informing me that the National Academy of Sciences have awarded to me the Henry Draper medal.

I beg, through you, to express to the Academy my high appreciation of this distinguished honor, and the further gratification it affords me to know that the award was unanimous.

I am, sir, yours faithfully,

WILLIAM HUGGINS.

To Professor REMSEN, etc.

REPORTS FROM TRUST FUNDS.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND FOR THE ACADEMY YEAR 1900–1901.

The board of directors of the Bache fund make the following statement, as a matter of courtesy to the Academy, of the appropriations made by them since the last stated meeting of the Academy, April, 1900:

1900.		
Apr. 5.	To Dr. H. C. Wood, for investigation of the relations between the pulmonary and systemic circulations (Of this appropriation $150 was unused and returned to the fund.)	$300
Apr. 10.	To Prof. Lewis Boss, for investigation of standard stars	1,000
Apr. 11.	To Prof. Asaph Hall, jr., for investigation of aberration and variation of latitude	250

The above appropriations have been already reported at the November meeting of the Academy.

1900.		
Apr. 28.	To Prof. A. S. Packard, for continuation of investigation of bombycine moths, for drawings	$300
Oct. 15.	To Dr. E. C. Franklin, for the investigation of solutions of various substances in substituted ammonias	150
1901.		
Jan. 8.	To Dr. S. Weir Mitchell and Simon Flexner, for investigation of snake venom	600
Mar. 5.	To Prof. Lewis Boss, for continuation of investigation of standard stars	1,000
Mar. 26.	To Prof. Alpheus Hyatt, for measurement of the Achatinellidæ of the Hawaiian Islands	600
Mar. 28.	To Prof. A. S. Packard, to complete the drawings for Part II of work on bombycine moths	300

At the beginning of the current year the board authorized the treasurer to transfer the sum of $2,000 to the invested income account from the cash income on hand.

Respectfully submitted.

Wolcott Gibbs.
Seth C. Chandler.
Sam. H. Scudder.

REPORT OF THE BOARD OF DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND FOR THE YEAR 1900–1901.

The directors of the Benjamin Apthorp Gould fund respectfully submit the following report:

The following appropriations have been made since the last stated meeting of the Academy, April, 1900:

1900.		
Apr. 18.	To Mr. John A. Parkhurst, for observations of variable stars, to be expended for charts	$30
Apr. 18.	To Dr. Herman S. Davis, for new reduction of Piazzi's observations, to be expended for computer	500
Dec. 15.	To Mr. Paul S. Yendell, for observations of variable stars, to be expended for photometric apparatus and construction of dome	225
Feb. 1.	To Prof. Simon Newcomb, investigation on the planes of the galaxy and the bright stars	25

In addition to the above the sum of $500 has been appropriated for the purpose of bringing up the arrears of cometary research, and offered to American astronomers for the compution of definitive orbits of certain specified comets, to be distributed among the computers taking part in the work, the relative apportionment to be hereafter determined by the board.

In accordance with the vote of the Academy, April 19, 1899, the directors have prepared a report of progress of all the work which they have encouraged, so far as such a report is practicable at the present time, and have handed the same to the president.

Asaph Hall.
Lewis Boss.
Seth C. Chandler.

The President of the National Academy:

In accordance with the vote of the Academy, April 19, 1899, the directors of the Benjamin Apthorp Gould fund herewith respectfully submit a report of progress on such work as they have encouraged, so far as it is practicable to make such a report at the present time:

Appropriation No. 1, to Doolittle, $500, of date 1899, March 28.

A computer was at work during the greater part of the year ending July 1, 1900. Although not completed at that time the final reduction was so far advanced that the first instalment of the work at Bethlehem on the variation of latitude and aberration was soon ready for the printer, and is now in process of publication by the American Philosophical Society of Philadelphia. It is hoped that the remainder will be in shape during the current summer and printed about one year from the present date.

Appropriation No. 2, to Mr. Henry M. Parkhurst, $300, of date 1899, March 25.

About two-thirds of the sum advanced was used for reconstruction of observatory and instruments and the remainder in instrumental improvements. The work done in the observations of variable stars has been printed in five communications to the

Astronomical Journal, and the continuation to date is nearly ready for printing. It is to be indefinitely continued in the future.

Besides this the work on the photometric observation of the asteroids has been continuously prosecuted to date, and especially those relating to Eros, which series already covers more than six months, and is ready for publication.

Appropriation No. 3, to John A. Parkhurst, $30, of date 1900, April 18.

Money expended in purchase of the first two parts of Hagen's Atlas of Variable Stars, to be used in conjunction with the 40-inch refractor of the Yerkes Observatory, Chicago, for the observation of the minima of the fainter variables. A specific account of the progress of this work has not yet been called for by the board.

Appropriation No. 4, to Dr. Herman S. Davis, $500, of date 1900, April 18.

A detailed report of the work done to date has been received by the board. The money has been used for the computation of the refractions and the reductions to apparent place, and enough of the appropriation is in hand to complete the computation of the refractions.

Appropriations Nos. 5 and 6 being quite recent, the board deems it too early to make a specific report with regard to them.

ASAPH HALL.
LEWIS BOSS.
SETH C. CHANDLER.

REPORT OF THE COMMITTEE ON THE WOLCOTT GIBBS FUND.

CAMBRIDGE, *April 9, 1901.*

DEAR SIR: I have the honor to report that the committee on the Wolcott Gibbs fund voted, when it was established, that the income of the fund should be paid to Dr. Wolcott Gibbs during his life.

Very respectfully,

C. L. JACKSON, *Chairman.*

The PRESIDENT OF THE NATIONAL ACADEMY.

ELECTIONS.

ELECTION OF OFFICERS.

Mr. Alexander Agassiz was elected president of the Academy, Mr. Ira Remsen, foreign secretary, and Mr. Arnold Hague, home secretary, for the ensuing term of six years.

Messrs. Billings, Bowditch, Brush, Hague, Langley, and Newcomb were elected members of the council.

Mr. S. P. Langley resigned.

ELECTION OF MEMBERS.

Messrs. George F. Becker, James McK. Cattell, Eliakim H. Moore, Edward L. Nichols, and T. Mitchell Prudden were elected members of the Academy.

ELECTION OF FOREIGN ASSOCIATES.

The following gentlemen were elected foreign associates: Eduard Bornet, Paris; Alfred Cornu, Paris; Sir Archibald Geikie, London; J. H. van't Hoff, Berlin; J. Janssen, Paris; Friedrich Kohlrausch, Berlin; Hugo Kronecker, Bern; Maurice Loewy, Paris.

DEATHS.

During the year 1901 the Academy lost by death five members and one foreign associate. Mr. Henry A. Rowland died on the 16th of April; Joseph Le Conte, July 6; Charles A. Schott, July 31; Richmond Mayo-Smith, November 11, and Clarence King, December 24. Mr. Henri de Lacaze-Duthiers, foreign associate, died July 21.

LIST OF PAPERS PRESENTED AT THE SCIENTIFIC SESSION.

The Use of Formulæ in Demonstrating the Relations of the Life History of an Individual to the Evolution of its Group. Alpheus Hyatt.

Artificial Parthenogenesis and its Relation to Normal Fertilization. E. B. Wilson.

Simultaneous Volumetric and Electric Graduation of the Condensation Tube. Carl Barus.

The Climatology of the Isthmus of Panama. Henry L. Abbot.

The Effects of Secular Cooling and Meteoric Dust on the Length of the Terrestrial Day. R. S. Woodward.

Table of Results of an Experimental Enquiry regarding the Nutritive Action of Alcohol, prepared by Prof. W. O. Atwater, of Middletown, Conn. Presented by J. S. Billings.

The Place of Mind in Nature. J. W. Powell.

The Significance of the Dissimilar Limbs of the Ornithopodous Dinosaurs. Theo. Gill.

The Foundation of Mind. J. W. Powell.

Conditions Affecting the Fertility of Sheep and the Sex of Their Offspring. Alexander Graham Bell.

The New Spectrum. S. P. Langley.

AUTUMN MEETING, PHILADELPHIA.

SCIENTIFIC SESSION.

A scientific session for the reading of papers having been called by the council, the academy met at Houston Hall, University of Pennsylvania, November 12–14. The foreign secretary, Mr. Ira Remsen, was chosen president pro tem.

The following members were present during the session: Messrs. Barker, Barus, Becker, Beecher, Billings, Boas, Bowditch, Brewer, Brush, Cattell, Chandler (C. F.), Chittenden, Comstock (C. B.), Crafts, Gill, Hague, Mitchell (S. W.), Morse, Nichols, Osborn, Peirce, Penfield, Remsen, Sellers, Smith (E. F.), Verrill, Welch.

The following papers were presented:

Biographical Memoir of Frederick Augustus Genth. George F. Barker.

Observations on Tungsten. Edgar F. Smith.

A New Gauge for the Direct Measurement of Small Pressures. Edward W. Morley and Charles F. Brush.

On the Logic of Research into Ancient History. Charles S. Peirce.

On the Vaso-motor Supply of the Lungs. Horatio C. Wood, jr. (Introduced by George F. Barker.)

On the use of the Stereographic Projection in Making Accurate Maps; with Criticism of some Recent Methods of Map Projection. Samuel L. Penfield.

Biographical Memoir of General John Newton. Cyrus B. Comstock.

Dolichocephaly and Brachycephaly as the Dominant Factors in Cranial Evolution. Henry F. Osborn.

Latent or Potential Homology. Henry F. Osborn.

Transmission of Heat through Vapor of Water at Small Pressures. Edward W. Morley and Charles F. Brush.

The Monatomic Gases. George F. Barker.

On the Pseudo-catalytic Action of Concentrated Acids. James M. Crafts.

Snake Venom in Relation to Hæmolysis, Bacteriolysis, and Toxicity. S. Weir Mitchell and Simon Flexner.

Note on Linear Force exerted by Growing Crystals. George F. Becker.

Note on the Orogenic Theory of Tilted Blocks. George F. Becker.

Cranial Evolution of Titanotherium II. Henry F. Osborn.

On Quadrant Electrometry with a Free Light Needle Highly Charged through a Conductor of Ionized Air. Carl Barus.

On Nuclear Condensation in the Vapor of Non-Electrolytes like Benzene; and on Graded Condensation. Carl Barus.

The Work of the International Association of Academies. Henry P. Bowditch.

A Method of Rearing Marine Larvæ. Caswell Grave. (Introduced by William K. Brooks.)

On the Newer Forms of Incandescent Electric Lamps. George F. Barker.

BUSINESS MEETING OF THE ACADEMY.

A business meeting of the academy, called by the council to consider the report of the president to Congress and such other business as might be presented, was held November 13, Mr. Ira Remsen, the foreign secretary, presiding.

The recommendation of the council that the president be authorized to include in his annual report to Congress the proceedings of the present meeting, as well as those of the meeting at Washington in April, 1901, and also any matters relating to government business that may be submitted to the academy prior to the presentation of his report, was approved.

The following announcements were made:

The academy was represented by W. G. Farlow, of Cambridge, at the meeting of the International Association of Botanists that met at Geneva August last.

Ira Remsen was appointed a delegate to represent the National Academy of Sciences at the bicentennial celebration of Yale University in October, 1901.

The president of the academy has appointed Edward S. Morse a member of the general committee on the International Congress of Americanists which will be held in New York in 1902.

Letters have been received from Messrs. Cornu, Sir Archibald Geikie, and M. Janssen, accepting foreign membership in the academy.

THE INTERNATIONAL ASSOCIATION OF ACADEMIES.

The International Association of Academies held its first general meeting in Paris in 1901. The eighteen academies which make up the International Association would all have been represented at the meeting had it not been that the delegate of the National Academy of Sciences, Prof. George L. Goodale, was prevented from being present by the condition of his health.

The amendments to Section X of the proposed statutes of the International Association of Academies proposed by the National Academy of Sciences, and seconded by the Royal Society of London, were adopted. The amendments are given below:

Such special committees shall consist of delegates appointed by the constituent academies with special reference to their qualification to deal with the questions under consideration.

The first meeting of such a committee shall be called by the president of the International Association or by the president of the council, and at this meeting each committee shall adopt rules for its own guidance.

Each special committee shall make a report embodying such recommendations as it may think advisable, to the president of the International Council, who shall transmit the same to the constituent academies.

The president of the council shall, however, have power if he see fit, before submitting such reports to the constituent academies, to submit the same to the council, and this body shall have power to refer back the report to the committee for further consideration.

It was decided to hold a general meeting in 1904.

Among the questions brought up for discussion were the following:

1. A plan for the mutual loaning of manuscripts, proposed by the Academy of Sciences of Berlin.

2. A study of the proper means of preparing and publishing a complete edition of the works of Leibnitz. This was presented by the Academy of Moral and Political Sciences of the Institute of France.

3. The Royal Society of London presented a report on the question of the extension of the geodetic arc along the thirtieth meridian.

4. On behalf of the Academy of Sciences of Berlin, M. Marey presented a report on a plan for the supervision of physiological instruments.

5. The Royal Saxon Society suggested the appointment of an expert committee on human and comparative embryology, and on the anatomy of the brain.

6. A communication was presented from the Royal Society of London concerning an International Catalogue of Scientific Literature of which this society has the direction.

A full report of the proceedings of the meeting has been published, and copies can be obtained through the foreign secretary of the Academy.

APPENDICES.

APPENDIX A.

CONSTITUTION AND RULES OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may,

however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

SEC. 2. The officers of the Academy, together with six members to be elected by the Academy at the first stated session in each year, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

SEC. 3. The president of the Academy, or in case of his absence or inability to act the vice-president, shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The six additional members of the council shall be elected, on any day after the first of the first stated session in each year, by each voter inscribing six names on his ballot, and those six who have received more votes than any others shall be declared elected. If two or more names have received the lowest number of votes that would elect, additional balloting shall be had for as many members as remain each time to be elected until the number is full.

The term of the members so elected shall commence at the close of the session at which they are elected and continue until the close of the first stated session in the next year.

SEC. 4. Nominations of members may be made in writing, signed by any five members of the Academy, at any stated session, to be voted on at the next stated session held in Washington, and each nomination shall, at the time of election, be accompanied by a written list of the original works of the nominee.

SEC. 5. The Academy shall be divided into six standing committees. In this classification a member who is eminent in more than one subject may be assigned to a corresponding number of committees. The classification shall be the following:

1. Mathematics and Astronomy.
2. Physics and Engineering.
3. Chemistry.
4. Geology and Paleontology.
5. Biology.
6. Anthropology.

In nominating for membership in the Academy, a statement must be made as to the subject or subjects in which the person nominated is eminent. Every nomination must be submitted, through the secretary, to all the members of the committee or committees representing the

subject or subjects in which the person nominated is stated to be eminent; and in order that his name may be brought before the Academy for election he must receive the votes of a majority of the members of the committee or committees to which his name has been referred.

Elections for membership shall be held in the following manner: Each member may inscribe on a ballot not more than five names of nominees selected from the list. Absent members may send such ballots to the home secretary. From the seven names receiving the highest number of votes in this preference ballot the members present may proceed to elect new members in the following manner: At each ballot each member present may vote for not exceeding three persons, and the person receiving the highest number of votes shall be declared elected, provided that he receive two-thirds of the votes cast and that his name appear on not less than twenty ballots; and provided further, that the number of members of the Academy be not already one hundred or over, in which case to be declared to be elected he must receive four-fifths of the votes cast, and his name must appear on at least twenty-five ballots.

Should several candidates have the same minimum number of votes on the preference list, the requisite number for completing the list shall be selected from them by a two-thirds vote of the members present.

Election of members shall be held only at the regular stated session of each year held in Washington, and not more than five members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. Foreign associates may be nominated by a committee of five members, to be appointed for that purpose by the president and elected at any stated session by a two-thirds vote of the members present. The election shall be had by each member indicating on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the ballots shall be declared elected.

SEC. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the Academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

SEC. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council, and afterwards to the Academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy, upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with

the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

SEC. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy at the same session. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.

7. Other business.

8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of Departments of the Govern-

ment, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1901-1902.

	Expiration of term.
Agassiz, Alexander, *President*	April, 1907.
Hall, Asaph, *Vice-President*	April, 1903.
Remsen, Ira, *Foreign Secretary*	April, 1907.
Hague, Arnold, *Home Secretary*	April, 1907.
Walcott, Charles D., *Treasurer*	April, 1904.

ADDITIONAL MEMBERS OF COUNCIL, 1901-1902.

Billings, J. S.
Bowditch, H. P.
Brush, G. J.
Newcomb, S.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
    - Abbe, C.
    - Boss, L.
    - Chandler, S. C.
    - Comstock, G. C.
    - Davidson, G.
    - Elkin, W. L.
    - Hall, A.
    - Hill, G. W.
    - Holden, E. S.
    - Langley, S. P.
    - Moore, E. H.
    - Newcomb, S.
    - Peirce, C. S.
    - Pickering, E. C.
    - Woodward, R. S.
    - Young, C. A.
2. Physics and Engineering.
    - Abbe, C.
    - Abbot, H. L.
    - Barker, G. F.
    - Barus, C.
    - Bell, A. G.
    - Comstock, C. B.
    - Gibbs, J. W.
    - Hastings, C. S.
    - Langley, S. P.
    - Mendenhall, T. C.

2. Physics and Engineering—Continued.
    - Michelson, A. A.
    - Mitchell, H.
    - Morley, E. W.
    - Morton, H.
    - Nichols, E. L.
    - Pickering, E. C.
    - Rood, O. N.
    - Sellers, W.
    - Trowbridge, J.
    - Woodward, R. S.
    - Wright, A. W.
3. Chemistry.
    - Barker, G. F.
    - Brush, G. J.
    - Chandler, C. F.
    - Chittenden, R. H.
    - Crafts, J. M.
    - Dana, E. S.
    - Gibbs, W.
    - Gooch, F. A.
    - Hilgard, E. W.
    - Hill, H. B.
    - Jackson, C. L.
    - Johnson, S. W.
    - Michael, A.
    - Morley, E. W.
    - Penfield, S. L.

3. Chemistry—Continued.
    - Remsen, I.
    - Richards, T. W.
    - Smith, E. F.
4. Geology and Paleontology.
    - Becker, G. F.
    - Beecher, C. E.
    - Dall, W. H.
    - Dutton, C. E.
    - Emmons, S. F.
    - Gilbert, G. K.
    - Hague, Arnold.
    - Leslie, J. P.
    - Osborn, H. F.
    - Packard, A. S.
    - Pumpelly, R.
    - Walcott, C. D.
    - White, C. A.
5. Biology.
    - Agassiz, A.
    - Allen, J. A.
    - Bowditch, H. P.
    - Brewer, W. H.
    - Brooks, W. K.
    - Chittenden, R. H.
    - Dall, W. H.
    - Farlow, W. G.
    - Gill, T. N.
5. Biology—Continued.
    - Goodale, G. L.
    - Minot, C. S.
    - Morse, E. S.
    - Osborn, H. F.
    - Packard, A. S.
    - Prudden, T. M.
    - Putnam, F. W.
    - Sargent, C. S.
    - Scudder, S. H.
    - Smith, S. I.
    - Verrill, A. E.
    - Walcott, C. D.
    - Welch, W. H.
    - White, C. A.
    - Whitman, C. O.
    - Wilson, E. B.
    - Wood, H. C.
6. Anthropology.
    - Billings, J. S.
    - Boas, F.
    - Cattell, J. McK.
    - Minot, C. S.
    - Mitchell, S. W.
    - Morse, E. S.
    - Powell, J. W.
    - Putnam, F. W.
    - Welch, W. H.

Executive Committee.

Walcott, C. D. Agassiz, A., ex officio.
Newcomb, S. Hague, Arnold, ex officio.
Langley, S. P.

On Weights, Measures, and Coinage.

Mendenhall, T. C., *Chairman.* Newcomb, S.
Michelson, A. A. Peirce, C. S.
Young, C. A.

On the Election of Foreign Associates.

Remsen, Ira, *Chairman.* Mitchell, S. W.
Hall, A. Newcomb, S.

On Publications of the Academy.

Gill, T. N.

TRUST FUNDS.

Board of Direction of the Bache Fund.

Gibbs, Wolcott, *Chairman.* Chandler, S. C.
Scudder, S. H.

Board of Trustees of the Watson Fund.

Newcomb, S., *Chairman.* Hall, A.
Boss, L.

The Henry Draper Fund.

Pickering, E. C., *Chairman.*
Trowbridge, J.
Newcomb, S.
Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

Brush, G. J., *Chairman.*
Johnson, S. W.
Morley, E. W.
Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

Hall, Asaph, *Chairman.*
Chandler, S. C.
Boss, Lewis.

The Barnard Medal.

Billings, J. S., *Chairman.*
Rood, O. N.
Bowditch, H. P.
Jackson, C. L.
Chandler, S. C.
Newcomb, S.

The Wolcott Gibbs Fund.

Jackson, C. L., *Chairman.*
Remsen, Ira.
Drown, T. M.

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, JANUARY 20, 1902.

		Date of election.
Abbe, Cleveland	*2017 I st. NW., Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum, New York City.*	1876
Barker, George F	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Beecher, Charles E	*New Haven, Conn.*	1899
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Boss, Lewis	*Albany, N. Y.*	1889
Bowditch, Henry P	*Jamaica Plain, Mass.*	1887
Brewer, William H	*418 Orange st., New Haven, Conn.*	1880
Brooks, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
Brush, George J	*14 Trumbull st., New Haven, Conn.*	1868
Cattell, James McK	*Columbia University, New York City.*	1901
Chandler, Charles F	*Columbia University, New York City.*	1874
Chandler, Seth C	*16 Craigie st., Cambridge, Mass.*	1888
Chittenden, Russell H	*New Haven, Conn.*	1890
Comstock, Cyrus B., U. S. A	*34 W. Twenty-fifth st., New York City.*	1884
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Crafts, James M	*59 Marlboro st., Boston, Mass.*	1872
Dall, William H	*Washington, D. C.*	1897
Dana, Edward S	*New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Dutton, Clarence E., U. S. A	*Washington, D. C.*	1884
Elkin, William L	*New Haven, Conn.*	1895
Emmons, Samuel F	*Washington, D. C.*	1892
Farlow, W. G	*Cambridge, Mass.*	1879

		Date of election.
Gibbs, Josiah Willard	*New Haven, Conn.*	1879
Gibbs, Wolcott	*Newport, R. I.*	——
Gilbert, Grove K	*Washington, D. C.*	1883
Gill, Theodore N	*Washington, D. C.*	1873
Gooch, Frank A	*New Haven, Conn.*	1897
Goodale, George L	*Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hall, Asaph	*South Norfolk, Conn.*	1875
Hastings, Charles S	*New Haven, Conn.*	1889
Hilgard, Eugene W	*Berkeley, Cal.*	1872
Hill, George W	*West Nyack, N. Y.*	1874
Hill, Henry B	*Cambridge, Mass.*	1883
Holden, Edward S	*U. S. Military Academy, West Point, N. Y.*	1885
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
Johnson, Samuel W	*54 Trumbull st., New Haven, Conn.*	1866
Langley, Samuel P	*Washington, D. C.*	1876
Lesley, J. Peter	*Milton, Mass.*	——
Mendenhall, Thomas C	*Worcester, Mass.*	1887
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A	*Chicago, Ill.*	1888
Minot, Charles S	*Boston, Mass.*	1897
Mitchell, Henry	*Nantucket, Mass.*	1885
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H	*University of Chicago, Chicago, Ill.*	1901
Morley, Edward W	*2238 Euclid ave., Cleveland, Ohio.*	1897
Morse, Edward S	*P. O. Box 268, Salem, Mass.*	1876
Morton, Henry	*Hoboken, N. J.*	1874
Newcomb, Simon, U. S. N	*1620 P st. NW., Washington, D. C.*	1869
Nichols, Edward L	*Cornell University, Ithaca, N. Y.*	1901
Osborn, H. F	*American Museum of Natural History, New York City.*	1900
Packard, A. S	*275 Angell st., Providence, R. I.*	1872
Peirce, Charles S	*Milford, Pa.*	1876
Penfield, S. L	*New Haven, Conn.*	1900
Pickering, Edward C	*Cambridge, Mass.*	1873
Powell, John W	*Washington, D. C.*	1880
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Putnam, Frederick W	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W	*Cambridge, Mass.*	1899
Rood, Ogden N	*New York City.*	1865
Sargent, Charles S	*Jamaica Plain, Mass.*	1895
Scudder, Samuel H	*Cambridge, Mass.*	1877
Sellers, William	*1819 Vine st., Philadelphia, Pa.*	1873
Smith, Edgar F	*Philadelphia, Pa.*	1899
Smith, Sidney I	*New Haven, Conn.*	1884
Trowbridge, John	*Cambridge, Mass.*	1878
Verrill, A. E	*New Haven, Conn.*	1872
Walcott, Charles D	*Washington, D. C.*	1896
Welch, William H	*935 St. Paul st., Baltimore, Md.*	1895
White, Charles A	*330 T st. NW., Washington, D. C.*	1889
Whitman, Charles O	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B	*Columbia University, New York City.*	1899

		Date of election.
Wood, Horatio C	*1925 Chestnut st., Philadelphia, Pa.*	1879
Woodward, Robert S	*Columbia University, New York City.*	1896
Wright, Arthur W	*New Haven, Conn.*	1881
Young, Charles A	*Princeton, N. J.*	1872

DECEASED MEMBERS.

	Date of death.
*Agassiz, Louis	Dec. 14, 1873
*Alexander, J. H	Mar. 2, 1867
*Alexander, Stephen	June 25, 1883
*Bache, Alexander Dallas	Feb. 14, 1867
*Baird, Spencer F	Aug. 19, 1887
Barnard, F. A. P	Apr. 27, 1889
Barnard, J. G	May 14, 1882
Bartlett, W. H. C	Feb. 11, 1893
*Brown-Sequard, Charles E	Apr. 2, 1894
*Casey, Thomas L	Mar. 25, 1896
*Caswell, Alexis	Jan. 8, 1887
*Chauvenet, William	Dec. 13, 1870
*Clarke, Henry James	July 1, 1873
*Coffin, James H	Jan. 6, 1873
*Coffin, J. H. C	Jan. 8, 1890
*Cook, George H	Sept. 22, 1889
*Cooke, Josiah P	Sept. 3, 1894
*Cope, Edward D	Apr. 12, 1897
Coues, Elliott	Dec. 25, 1899
Dalton, J. C	Feb. 2, 1889
Dana, James D	Apr. 14, 1895
*Davis, Charles H	Feb. 18, 1877
*Draper, Henry	Nov. 20, 1882
*Draper, John W	Jan. 4, 1882
*Eads, James B	Mar. 8, 1887
*Engelman, George	Feb. 4, 1884
*Ferrel, William	Sept. 18, 1891
*Frazer, John Fries	Oct. 12, 1872
*Gabb, William M	May 30, 1878
*Genth, F. A	Feb. 2, 1893
*Gilliss, James Melville	Feb. 9, 1865
*Goode, G. Brown	Sept. 6, 1896
*Gould, Augustus A	Sept. 15, 1866
Gould, Benjamin A	Nov. 27, 1896
*Gray, Asa	Jan. 30, 1888
*Guyot, Arnold	Feb. 8, 1884
*Hadley, James	Aug. 1, 1834
*Haldeman, S. S	Sept. 20, 1880
Hall, James	Aug. 8, 1898
*Hayden, F. V	Dec. 22, 1887
*Henry, Joseph	May 13, 1878
*Hilgard, Julius E	May 8, 1891
*Hitchcock, Edward	Feb. 27, 1864
*Holbrook, J. E	Sept. 8, 1871

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*Biographical notices have been presented of those designated by an asterisk.

	Date of death.
*Hubbard, J. S	Aug. 16, 1863
*Humphreys, A. A	Nov. 28, 1883
Hunt, T. Sterry	Feb. 12, 1892
Hyatt, Alpheus	Jan. 16, 1902
Keeler, J. E	Aug. 12, 1900
King, Clarence	Dec. 24, 1901
*Kirkland, Jared P	Dec. 10, 1877
*Lane, J. Homer	May 3, 1880
*Le Conte, John	Apr. 29, 1891
*Le Conte, John L	Nov. 15, 1883
Le Conte, Joseph	July 6, 1901
Lea, Matthew C	Mar. 15, 1897
Leidy, Joseph	Apr. 30, 1891
*Lesquereux, Leo	Oct. 25, 1889
Longstreth, Miers F	Dec. 27, 1891
*Loomis, Elias	Aug. 16, 1889
Lovering, Joseph	Jan. 18, 1892
Lyman, Theodore	Sept. 10, 1897
*Mahan, D. H	Sept. 16, 1871
*Marsh, G. P	July 23, 1882
Marsh, O. C	Mar. 18, 1899
Mayer, Alfred M	July 13, 1897
Mayo-Smith, Richmond	Nov. 11, 1901
*Meek, F. B	Dec. 21, 1877
*Meigs, M. C	Jan. 2, 1892
*Morgan, Lewis H	Dec. 14, 1881
Newberry, J. S	Dec. 7, 1892
*Newton, H. A	Aug. 1, 1896
*Newton, John	May 1, 1895
*Norton, William A	Sept. 21, 1883
*Oliver, James E	Mar. 27, 1895
Peters, C. H. F	July 18, 1890
*Pourtales, L. F	July 19, 1880
Rodgers, John	May 5, 1882
Rogers, Fairman	Aug. 23, 1900
Rogers, Robert E	Sept. 7, 1884
*Rogers, Wm. A	Mrr. 1, 1898
*Rogers, William B	May 30, 1882
Rowland, Henry A	Apr. 16, 1901
*Rutherfurd, Lewis M	May 30, 1892
*Saxton, Joseph	Oct. 26, 1873
Schott, Charles A	July 31, 1901
*Silliman, Benj., Sr	Nov. 24, 1864
Silliman, Benj., Jr	Jan. 14, 1885
*Smith, J. Lawrence	Oct. 12, 1883
*Stimpson, William	May 26, 1873
*Strong, Theodore	Feb. 1, 1869
*Sullivant, W. S	Apr. 30, 1873
*Torrey, John	Mar. 10, 1873
*Totten, J. G	Apr. 22, 1864
*Trowbridge, William P	Aug. 12, 1892

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*Biographical notices have been presented of those designated by an asterisk.

	Date of death.
Trumbull, James H	Aug. 5, 1897
*Tuckerman, Edward	Mar. 15, 1886
Walker, Francis A	Jan. 5, 1897
*Warren, G. K	Aug. 8, 1882
*Watson, James C	Nov. 23, 1880
*Watson, Sereno	Mar. 9, 1892
*Winlock, Joseph	June 11, 1875
*Woodward, J. J	Aug. 17, 1884
*Worthen, A. H	May 6, 1888
*Wyman, Jeffries	Sept. 4, 1874

FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Baeyer, Adolph (Ritter von)	*Munich.*
Berthelot, M. P. E	*Paris.*
Bornet, Edouard	*Paris.*
Cornu, Alfred	*Paris.*
Gegenbaur, Karl	*Heidelberg.*
Geikie, Sir Archibald	*London.*
Gill, David	*Cape Town.*
Hoff, J. H. van't	*Berlin.*
Hooker, Sir J. D	*London.*
Janssen, J	*Paris.*
Kelvin (Lord)	*London.*
Klein, Felix	*Göttingen.*
Kohlrausch, Friedrich	*Berlin.*
Kölliker, Albert von	*Würzburg.*
Kronecker, Hugo	*Bern.*
Lister (Lord)	*London.*
Loewy, Maurice	*Paris.*
Moissan, Henri	*Paris.*
Poincaré, Henri	*Paris.*
Rayleigh (Lord)	*London.*
Richthofen, F. von	*Berlin.*
Stokes, Sir George G	*Cambridge.*
Strasburger, Edouard	*Bonn.*
Struve, Otto von	*Karlsruhe.*
Suess, Edouard	*Vienna.*
Virchow, Rudolph von	*Berlin.*
Zittel, Karl Alfred (Ritter von)	*Munich.*

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*Biographical notices have been presented of those designated by an asterisk.

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.
C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.
Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekulé.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.
Henri de Lacaze-Duthiers.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1902.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1902.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.

LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE PAST YEAR, 1902.

NATIONAL ACADEMY OF SCIENCES,
Washington, D. C., January 10, 1903.

SIR: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

ALEXANDER AGASSIZ,
President of the National Academy of Sciences.

The PRESIDENT OF THE SENATE.

ACT OF INCORPORATION.

AN ACT to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Pierce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherfurd, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT to amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882.*

True copies.

SEVELLON A. BROWN,
Chief Clerk.

AN ACT to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN,
Chief Clerk.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

The president presented the following report for the past year, which was accepted by the Academy:

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1902 the Academy held three sessions. The first was the regular annual session held at Washington April 15 to 17, inclusive; the second, a scientific session held at Baltimore November 11 and 12; the third, a special session held at Baltimore November 12 for the transaction of business.

ANNUAL MEETING.

The session was held at the U. S. National Museum, Washington, the president, Mr. Alexander Agassiz, presiding.

The following members were present during the session: Messrs. Abbe, Abbot, Agassiz, Allen, Becker, Billings, Boas, Boss, Brewer, Brooks, Cattell, Chandler (C. F.), Chandler (S. C.), Chittenden, Comstock (C. B.), Crafts, Dall, Emmons, Farlow, Gilbert, Gill, Hague, Hall, Hill (G. W.), Langley, Minot, Mitchell (S. W.), Moore, Morley, Newcomb, Nichols, Osborn, Peirce, Penfield, Pickering, Prudden, Remsen, Richards, Sellers, Smith (E. F.), Walcott, Welch, White, and Woodward.

REPORT OF THE HOME SECRETARY.

WASHINGTON, D. C., *April 15, 1902.*

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to present herewith my report as home secretary of the National Academy of Sciences for the year ending April 15, 1902.

The president's annual report for 1901 was presented to Congress January 20, and the usual edition of 500 copies for the use of the

Academy was received from the Public Printer. About 100 copies were distributed to members of the Academy. In addition to the above, 100 copies were distributed to libraries in the United States and to the foreign associates.

The Fifth Memoir of Volume VIII (Anatomy of Nautilus Pompilius) was received from the Public Printer April 18, 1901. A copy was mailed to each member of the Academy, and 375 copies were sent to foreign libraries. Prof. W. K. Brooks received 200 copies, and 150 were presented to Dr. L. E. Griffin, the author of the memoir.

The Sixth Memoir of Volume VIII (An Experimental Inquiry Regarding the Nutritive Value of Alcohol) was sent to the Public Printer November 20, 1901. The full edition was received during the present month, but has not yet been distributed, except to members of the Academy.

Biographical memoirs of F. A. Genth and Gen. John Newton have been printed and the usual number of copies transmitted to the authors.

Volume IV of the Biographical Memoirs has also been printed and distributed to members. It contains the biographical memoirs of the following late members of the Academy: George Engelmann, Charles Henry Davis, James Edward Oliver, Fielding Bradford Meek, Charles E. Brown-Sequard, Hubert Anson Newton, Thomas Lincoln Casey, George Hammell Cook, George Brown Goode, Josiah Parsons Cooke, William Augustus Rogers, Frederick Augustus Genth, and John Newton.

A large number of packages containing publications of learned societies, etc., have been received and stored in the Smithsonian building, as in former years.

The publications of the Academy are now in much better condition for preservation than for some time past. They are stored on shelves in the towers of the Smithsonian building, and are easily accessible. Copies of any publications of the Academy still in stock can readily be obtained by the members.

There are at present 87 names on the active membership list of the Academy.

Very respectfully,

Arnold Hague, *Home Secretary.*

REPORT OF THE TREASURER.

WASHINGTON, D. C., *April 15, 1902*.

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 15, 1902.

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	Smith fund.	Gould fund.	Emmons and Gill trustees.	Building fund.
Balance brought forward:								
Cash	$1,011.12	$1,166.26	$1,786.30	$1,660.39	$174.76	$1,151.79	$340.48	....
Invested income.	500.00	3,000.00	2,993.71	....	1,496.57	....	....	....
Interest	310.10	2,364.30	1,125.51	368.20	375.96	965.00	255.00	....
Members' tax....	445.00	....	....	....	....	....	....	....
Appropriations returned	....	206.58	....	....	....	63.45	....	....
Subscriptions	1,750.00	....	....	....	....	....	....	$1,500.00
Total.......	4,016.22	6,737.14	5,905.52	2,028.59	2,047.29	2,180.24	595.48	1,500.00
Disbursed........	358.36	3,744.28	1,170.86	512.60	13.16	636.35	175.35	....
Balance:								
Cash	1,157.86	1,992.86	1,740.95	1,515.99	537.56	543.89	420.13	500.00
Invested income.......	2,500.00	1,000.00	2,993.71	....	1,496.57	1,000.00	....	1,000.00
Total accounted for	4,016.22	6,737.14	5,905.52	2,028.59	2,047.29	2,180.24	595.48	1,500.00

Very respectfully,

CHAS. D. WALCOTT, *Treasurer*.

The treasurer's report was referred to an auditing committee, consisting of Messrs. Emmons, Gill, and Dall, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer; also that they have examined the securities and papers found in the box of the Academy at the American Security and Trust Company's building, and found them to correspond to the list furnished by the treasurer.

S. F. EMMONS.
THEO. N. GILL.
WM. H. DALL.

RESIGNATION OF THE TREASURER.

Mr. Walcott tendered his resignation of the office of treasurer, to take effect immediately after the approval of his accounts by the auditing committee.

REPORT OF TRUST FUNDS.

REPORT OF THE BOARD OF DIRECTION OF THE BACHE FUND FOR THE ACADEMY YEAR 1901–2.

The board of directors of the Bache fund make the following statement, as a matter of courtesy to the Academy, of the appropriations made by them since the last stated meeting of the Academy, April, 1901:

1901.		
May 11.	To Prof. Charles L. Doolittle, for investigation of the constant of aberration and of variation of latitude	$500
Sept. 10.	To Prof. Ira Remsen, for continuation by Mr. L. E. Jewell of Rowland's work on the solar spectrum	1,000
Oct. 12.	To Prof. Edward S. Morse, for investigation on living brachiopods, for illustrative plates	500
Nov. 1.	To Prof. Charles Baskerville, for investigation of the element thorium.	300
1902.		
Jan. 21.	To Dr. S. Weir Mitchell and Dr. Simon Flexner, for continuation of researches on effects of snake venom	800

In consequence of the death of Prof. Alpheus Hyatt before the completion of the investigation for which the appropriation of 1901, March 26 ($600), was made, the board of directors have arranged with Dr. Alfred G. Mayer for the completion in accordance with the original plans of Professor Hyatt.

By arrangement of the board with the executor of the estate of Prof. Henry A. Rowland an unexpended balance of $206.58, remaining from the appropriation of 1899, November 8 ($700), has been returned to the fund.

Near the beginning of 1902 the board authorized the treasurer to transfer the sum of $1,000 from its invested income account to its available cash income account.

Respectfully submitted.

Wolcott Gibbs.
Seth C. Chandler.
Samuel H. Scudder.

REPORT OF THE DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND FOR THE ACADEMY YEAR 1901–2.

The directors of the Benjamin Apthorp Gould fund respectfully submit the following report:

The following appropriations have been made since the last stated meeting of the Academy, April, 1901:

1901.		
Nov. 4.	To Dr. Herman S. Davis, for the continuation of his new reduction of Piazzi's observations	$500
1902.		
Feb. 1.	To Prof. W. W. Payne, for a computer to assist Dr. H. C. Wilson in his measurement and reduction of the photographs of the planet Eros for the purpose of the solar parallax	300

In addition to the above immediate appropriations, the directors have entered into the following agreement for a deferred appropriation:

Dr. HERMAN S. DAVIS:

We agree to pay you the sum of two thousand five hundred dollars ($2,500) in a warrant for that amount drawn upon the treasurer of the National Academy of Sciences, upon the receipt from you on or before January 1, 1910, either of a printed copy of the final results of your "New reduction of Piazzi," or on the deposit by you of a manuscript copy of the same, ready for printing, with the National Academy of Sciences.

A further condition of this grant is that you inform us two years in advance of the date when such copy is likely to be ready, on the receipt or deposit of which, as above stated, the payment herein promised will be due.

ASAPH HALL,
SETH C. CHANDLER,
LEWIS BOSS,
Board of Directors of the Benjamin Apthorp Gould Fund.

August 1, 1901.

For the establishment of a sinking fund, principally to meet the above deferred and contingent liability, the board at the beginning of 1902 authorized the treasurer to transfer the sum of $1,000 from the cash income account to an invested income account.

In January, 1902, the fund received from Mr. Paul S. Yendell the sum of $63.45 as an unexpended balance of the appropriation made him December 15, 1900 ($225).

Respectfully submitted.

ASAPH HALL.
LEWIS BOSS.
SETH C. CHANDLER.

REPORT OF THE COMMITTEE ON THE WOLCOTT GIBBS FUND.

The committee on the Wolcott Gibbs fund has the honor to report that it voted, when the fund was put in its charge, to appropriate the income to Dr. Wolcott Gibbs during his life.

Very respectfully,

CHARLES L. JACKSON, *Chairman.*

REPORT OF THE WATSON TRUSTEES.

Shortly after the annual meeting of the Academy in 1901, an arrangement was made with Prof. A. O. Leuschner, University of California, for having the work of computing the perturbations of the Watson asteroids done by two of his assistants, he superintending the whole. The result of this arrangement has been extremely satisfactory. The work so far done proves to be far better than that done in the miscellaneous way heretofore followed. It is hoped that Professor Leuschner will be able to go on and have all the tables prepared.

The tables of Minerva by Professor Eichelberger have been done some two years, but their publication has been delayed, partly because it seemed desirable that all the tables should be published on a uniform plan, perhaps in a single volume, and partly because the deviations from observation gave rise to a suspicion of something being wrong in them.

Since October last, a period of six months, the expenditures on this work have been $1,135.75. This still leaves a balance of about $1,500 unexpended income. The exact balance must be learned from the report of the treasurer. Owing to the prospective absence of the chairman of the board in Europe, it is respectfully requested that the Academy authorize the treasurer to pay all vouchers for this work, properly certified by Professor Leuschner. If neccessary, the approval of the next member of the board may be required.

Respectfully submitted.

SIMON NEWCOMB, *Chairman.*

ELECTION OF OFFICERS.

Mr. Samuel F. Emmons was elected treasurer of the Academy in place of Mr. Charles D. Walcott, resigned.

Messrs. Brush, Billings, Bowditch, Walcott, Welch, and Newcomb were elected members of the council.

ELECTION OF MEMBERS.

Messrs. William W. Campbell, George E. Hale, C. Hart Merriam, William Trelease, and Charles R. Van Hise were elected members of the Academy.

DEATHS.

During the year 1902 the Academy lost by death three members, Henry Morton, May 9, John W. Powell, September 23, and Ogden N. Rood, November 12; and two foreign associates, Alfred Cornu, of Paris, in April, and Rudolph von Virchow, of Berlin, in September.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

Evolution of the Titanotheres III. Models and Restorations. Henry F. Osborn.

Homoplasy and Latent Homology. A Correction. Henry F. Osborn.

Evidence that North America and Eurasia Constituted a Single Zoological Realm during the Mesozoic and Cenozoic, and that Correlations can be Established as a Basis for Uniformity of Geological Nomenclature. Henry F. Osborn.

Monograph of the Bombycine Moths of America, including their Transformation; with a Revision of the Known Genera. Part III. Sphingicampidæ. Alpheus S. Packard.

On the Coral Reefs of the Maldives. Alexander Agassiz.

On the Theory of the Formation of Coral Reefs. Alexander Agassiz.

Psychophysical Fatigue. J. McK. Cattell.

On Some Optical Properties of Asphalt. Edward L. Nichols.

The Classification of the Sciences. Charles S. Peirce.

The Postulates of Geometry. Charles S. Peirce.

The Color System. Charles S. Peirce.

The Compulsory Introduction of the French Metrical System into the United States. William Sellers.

The Disintegration of Comets. Asaph Hall.

A New Computation of the Coefficients of Precession and Nutation. Ira Ibsen Sterner. (Introduced by Asaph Hall.)

The Distribution of the Stars. E. C. Pickering.

The Variability in Light of Eros. E. C. Pickering.

The Physiological Station on Monte Rosa. H. P. Bowditch. (With lantern illustrations.)

On Catalysis. James M. Crafts.

The Atomic Weight of Caesium. T. W. Richards.

The Significance of Changing Atomic Volume. T. W. Richards.

Determination of the Weight of the Vapor of Mercury at Temperatures Below 100°. Edward W. Morley.

Biography of Prof. William A. Rogers. Arthur Searle. (Presented by Edward W. Morley.)

Biographical Memoir of Gen. J. G. Barnard. Henry L. Abbot.

Biographical Memoir of Gen. Francis A. Walker. John S. Billings.

Biographical Memoir of J. S. Newberry. C. A. White.

The Present Aspect of Our Knowledge as to the Constant of Aberration. S. C. Chandler.

GOVERNMENT BUSINESS.

The president read a letter from the Hon. J. H. Southard, chairman of the Committee on Coinage, Weights, and Measures of the House of Representatives, asking the opinion of the Academy on certain features of the bill pending in the House for the compulsory introduction of the French metrical system into the United States.

The letter was referred to the committee of the Academy on weights, measures, and coinage, which presented a majority report signed by C. S. Peirce and William Sellers.

Mr. C. B. Comstock presented a minority report.

Mr. Southard's letter is as follows :

COMMITTEE ON COINAGE, WEIGHTS, AND MEASURES,
HOUSE OF REPRESENTATIVES,
Washington, D. C., April 15, 1902.

The PRESIDENT NATIONAL ACADEMY OF SCIENCES,
Washington, D. C.

DEAR SIR: I have the honor to inform you that there is now pending before Congress a bill providing for the sole use of the standards of the metric system of weights and measures in the departments of the Government after January 1, 1904, and their adoption as the legal standards of the United States after January 1, 1907.

This measure has been referred to the Committee on Coinage, Weights, and Measures for consideration, and it is the opinion of this committee that the general use of the metric system may be brought about in this manner without any compulsory legislation. The Attorney-General, in a legal opinion upon this measure, states that the bill as it now reads will not prohibit the use of the old weights and measures. The misunderstanding on this point has resulted in some opposition to the measure. The objections to compulsory legislation are therefore avoided, and at the same time it is believed that the exclusive use by the metric system by the Government and the fact that there will be no official standards of the old system after 1907 will finally result in the complete adoption of the metric system of weights and measures in the United States.

I would respectfully request the opinion of the Academy upon two points involved in the measure: First, as to whether the international metric system is desirable for general use in this country; and, second, as to whether the above dates allow sufficient time for those interested to make the necessary preparation to use the new system.

Respectfully,

J. H. SOUTHARD, *Chairman.*

After full discussion, the Academy adopted the following resolution:

Resolved, That the president is directed to inform Mr. Southard that the National Academy of Sciences approves of the use of the metric system for scientific work; but the question of the practical application of the metric system to the industries of the country is one that does not appear to be within the scope of the Academy as the scientific advisor of the Government.

AUTUMN MEETING OF THE ACADEMY.

SCIENTIFIC SESSION.

[Held in Baltimore November 11 and 12, 1902.]

A scientific session for the reading of papers having been called by the council, the Academy met at the physical laboratory of the Johns Hopkins University, Baltimore, November 11 and 12, the president, Mr. Alexander Agassiz, presiding.

The following members were present during the session: Messrs. Abbe, Agassiz, Barker, Becker, Boss, Bowditch, Brewer, Brooks, Brush, Cattell, Chandler (C. F.), Dall, Dutton, Gill, Hague, Hale, Langley, Mitchell (S. W.), Newcomb, Nichols, Osborn, Penfield, Remsen, Sellers, Walcott, Welch, and Wood.

The following papers were presented:

The Spectra of Stars of Secchi's Fourth Type. George E. Hale.

The Embryology of Salpa Cordiformis. W. K. Brooks.

The Occurrence of Reef Corals near Beaufort, N. C. Caswell Grave. (Introduced by W. K. Brooks.)

The Trematode Parasites of the Oyster. D. H. Tennent. (Introduced by W. K. Brooks.)

On Displacement Currents. J. B. Whitehead. (Introduced by Ira Remsen.)

On Elevated Oceanic Islands in the Pacific. Alexander Agassiz.

The Preparation of Cells for the Measurement of Osmotic Pressure. H. N. Morse. (Introduced by Ira Remsen.)

A Substance with Remarkable Optical Properties, and Screens Transparent only to Ultra Violet Light. R. W. Wood. (Introduced by Ira Remsen.)

A New System of Positions for Standard Stars, with Notes Relative to its Bearing upon Sidereal Astronomy. Lewis Boss.

On the Spectrum of Hydrogen. L. A. Parsons. (Introduced by Ira Remsen.)

A Possible Explanation of the Difficult Solubility of Certain Compounds containing Fluorine and Hydroxyl. S. L. Penfield.

New or Little-known Elephants and Mastodons of North America. H. F. Osborn.

Complete Skeleton and Restoration of the Cretaceous Fish *Portheus Molossus* Cope. H. F. Osborn.

A New Small Dinosaur from the Jurassic or Como Beds of Wyoming, apparently a Bird-Catcher. H. F. Osborn.

Biographical Memoir of Henry A. Rowland. T. C. Mendenhall.

Good Seeing. S. P. Langley.

"Good Seeing" is the title of a paper by Mr. Langley proposing a novel plan for artificially creating the conditions of "good seeing" through a telescope, primarily by abandoning the present practice of keeping the air in an ordinary tube as still as possible, and, on the contrary, violently agitating it, but also by extending the tube itself, as though by a prolonged dew-cap, and by churning or stirring the air through it, obtaining a stillness of the image and conditions of general good seeing such as have hitherto been supposed to be out of the astronomer's control.

BUSINESS MEETING.

[Baltimore, November 12, 1902.]

A business meeting of the Academy, called by the council to consider the report of the president to Congress and such other business as might be presented, was held November 12, with the president, Mr. Alexander Agassiz, in the chair.

The following recommendations of the council were adopted:

That an appropriation of $800 be made from the J. Lawrence Smith fund to aid Mr. O. C. Farrington, of the Field Columbian Museum, Chicago, in his researches on meteorities.

That the biographical notice of Mr. Augustus A. Gould, prepared by Dr. Jeffries Wyman, be published by the Academy.

That the biographical notice of Dr. John Edward Holbrook, prepared by T. L. Ogier, of Charleston, S. C., be accepted for publication as one of the biographical memoirs of the Academy.

That a committee on publication, to consist of the president, home secretary, and Mr. C. D. Walcott, be appointed with power to act.

That the president be appointed a member of the permanent council of the International Association of Academies.

The following letter was received from Senator J. R. Burton:

United States Senate,
Committee on Forest Reservations and the Protection of Game,
April 16, 1902.

Prof. Alex. Agassiz,
President National Academy of Sciences, Washington, D. C.

Dear Sir: There is now before Congress a bill looking to the establishment of a national forest reserve to include the higher and larger masses of mountains in the Southern Appalachian region.

This measure is to be considered at an early date by the Senate Committee on Forest Reservations, and in order that the best interests of the country may be served in this connection I will be greatly pleased if the Committee on Forest Reservations may have the benefit of the Academy's advice.

Yours, very truly, J. R. Burton.

The president appointed Messrs. Sargent, Abbot, and Brewer a committee to consider the matter.

Their report, which was sent to Senator Burton, is as follows:

Boston, *April 30, 1902.*

Alexander Agassiz, Esq.,
President National Academy of Sciences.

Sir: The committee of the Academy to whom you have referred the request of the chairman of the Committee on Forestry of the Senate of the United States for an opinion on the advisability of establishing an Appalachian forest reserve, have examined Senate Document No. 84, Fifty-seventh Congress, first session, being the message from the President of the United States transmitting a report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the Southern Appalachian region (without the accompanying illustrations), and a copy of Senate bill 5228, for the purchase of a national forest reserve in the Southern Appalachian Mountain region, to be known as the "National Appalachian Forest Reserve," and beg to state that they are in full sympathy with the principle of forest reservations intended to preserve the gradual distribution of rainfall in the flow of rivers heading therein.

They do not feel, however, without a personal examination of the region in question, qualified to give an opinion as to whether the recent disastrous floods in various rivers flowing from the Appalachian Mountains, recounted in the reports transmitted by the Bureau of Forestry and by the Geological Survey and contained in Document No. 84, resulted from the actual destruction of the forests, and as to whether their repetition could be prevented by a restoration of the forest growth. No data or records are presented to show that floods equally large did not occur in older times.

To make a proper report would require a certain time, as well as an appropriation to meet the expenses incurred by the committee of the academy.

As regards the provisions of the bill, it appears to the committee to be absolutely essential that the Government shall have full ownership and control of all reserved lands, and that these shall be in large continuous blocks. To limit such ownership to detached lots, surrounded by areas held by private parties upon whose concurrence success must depend, would seem to be entering on a dangerous copartnership likely to result in large expenditures and litigation.

C. S. Sargent,
Henry L. Abbot,
Wm. H. Brewer,
Committee.

THE INTERNATIONAL ASSOCIATION OF ACADEMIES.

The following reports have been received from the chairman of the international council of the association regarding the expediency of taking part in an international seismological conference:

International Association of Academies,
The Royal Society,
Burlington House, London, W., August 2, 1902.

Dear Sir and Esteemed Colleague: The Royal Society has been consulted by His Majesty's Government as to the desirability of Great Britain taking part in an international conference on earthquakes which was proposed at an international seismological conference held at Strassburg April, 1901, and towards the establishment of which the initial steps have been taken by the German Government.

The Royal Society being of opinion that the matter is one falling distinctly within the province of the association of academies, have desired me, as their delegate on the international council, and also chairman of that body, to ascertain, so far as can be done, the views of the international council as representing the constituent academies concerning the desirability of establishing the proposed international inquiry. The expression of these views will greatly assist the Royal Society in deciding what advice to give to the British Government.

I inclose a copy of the resolution passed at the above-mentioned conference, as well as a copy of draft statutes suggested for the proposed association.

I may venture to call your attention to the fact that, besides the national investigations carried out by Japan, Italy, Germany, Austria, and Russia, the British Association for the Advancement of Science, working by means of a committee and with the cooperation of His Majesty's Government, has carried out seismological observations since 1897 at thirty-six stations in various parts of the world. These observations may be spoken of as international in character.

Although, as I am aware, the time is a very inconvenient one, most of the academies being in vacation, I shall be glad to receive an answer from you as soon as possible, since His Majesty's Government has been requested to give in its answer by October 1.

It is to be regretted that a matter so clearly within the province of work for which the Association of Academies was established, was not formally brought before the association at an early date.

I am, yours, very faithfully,

M. Foster,
Chairman of the International Council of the Association of Academies.

Resolution Adopted at the First International Seismological Conference at Strassburg April, 1901.

"La Conférence sismologique de Strasbourg considérant le grand intérêt d'une action commune dans l'ensemble du Monde, recommande la création d'une association des Etats pour l'exécution de certaines tâches qui ne peuvent être menées à bien par l'initiative individuelle ou régionale, demande au haut Gouvernement de l'empire allemand de faire les démarches préparatoires pour amener à un traité d'association."

Projet de Statuts pour une Association Internationale de Sismologie.

§ 1. L'Association a pour objet les recherches tendant à la solution de tous les problèmes de la Sismologie, solution qui n'est possible qu'avec le concours de nombreuses stations sismologiques distribuées sur différents points de la terre.

Pour atteindre ce but, les principaux moyens sont:

1. Observations d'après des principes communs (approuvés par l'Association).
2. Expériences sur des questions d'une importance toute particulière.
3. Fondation et entretien d'observatoires sismiques dans tous les pays qui demandent des subventions à l'Association.
4. Organisation d'un Bureau central pour la centralisation, l'étude, le groupement et la publication des rapports envoyés par les différents pays.

§ 2. Sont Membres de l'Association tous les Etats qui y ont déclaré leur adhésion. L'admission dans l'Association a lieu sur demande adressée au président de la commission permanente.

§ 3. Les organes de l'Association sont:

1. L'Assemblée générale,
2. La Commission permanente,
3. Le Bureau central.

§ 4. L'Assemblée générale se compose des délégués officiels des Etats, membres de l'Association.

Chaque Etat de l'Association, représenté par un ou par plusieurs délégués, n'a qu'une seule voix délibérative.

L'Assemblée générale se réunit au moins tous les quatre ans. Elle est convoquée par le Président de la Commission permanente et avec l'assentiment de celle-si.

Les sismologues qui sont en rapports réguliers avec leur Bureau national peuvent, sur leur demande, être invités par celui-ci à assister à l'Assemblée générale. Ils seront considérés comme membres extraordinaires de l'Assemblée et n'auront qu'une voix consultative.

Ont en outre accès à l'Assemblée générale les personnes qui sont invitées par le Président de la Commission permanente.

§ 5. La Commission permanente se compose du Directeur du Bureau central et des délégués nommés par les Etats, membres de l'Association.

Chaque Etat ne peut désigner qu'un délégué.

La Commission permanente élit dans son sein le Président, le Vice-président et le Secrétaire général.

La fonction de Président de la Commission permanente et celle de Directeur du Bureau central ne peuvent pas être simultanément remplies par la même personne.

La Commission permanente procède à l'expédition de ces affaires courantes ou dans des séances ou par correspondance, au gré des besoins. Elle établit son Règlement.

§ 6. Le Secrétaire général présente à chaque Assemblée générale un rapport sur les travaux et la situation de l'Association.

Le Directeur du Bureau central présente un rapport embrassant tout le champ d'activité de ce Bureau.

§ 7. Le siège du Bureau central est fixé par l'Assemblée générale; il ne pourra être changé qu'à l'unanimité des voix de l'Assemblée générale.

Le Bureau central recueille les rapports fournis par les différents pays, il en donne des résumés généraux, qui seront publiés dans des revues semi-périodiques.

§ 8. Les Etats faisant partie de l'Association s'engagent à communiquer au Bureau central de l'Association les résultats des observations et des expériences faites dans leur pays et recueillies par leur Bureau national.

§ 9. Les Etats, membres de l'Association, versent leurs parts contributives annuelles au Bureau central de l'Association. Le montant de ces versements est fixé d'après le nombre de la population de ces Etats.

Les sommes versées par les différents Etats sont employées:

1. Pour les frais de publication et d'administration;
2. Pour l'indemnité du Secrétaire général;

3. Pour des subventions à des recherches d'une importance tout particulière.
4. Pour l'entretien des observatoires sismologiques fondés par l'Association.

La répartition des sommes affectées à ces différents postes se fait par la Commission permanente.

The following announcements were made:

That the Academy was represented by C. R. Van Hise and E. H. Moore at the installation of Edmund J. James, LL. D., as president of the Northwestern University in October, 1902; and by Edgar F. Smith at the installation of Joseph Swaim, LL. D., as president of Swarthmore College on November 15, 1902.

Mr. Newcomb was appointed a delegate to represent the Academy at the centennary of the birth of Abel, the Norwegian mathematician, held at Christiania the 5th of September, 1902.

The president reported that he had delivered the gold medal awarded to Sir William Huggins by the trustees of the Draper fund.

Before announcing the final adjournment of the session, President Agassiz expressed to President Remsen the appreciation and thanks of the members for the hospitality extended by the Johns Hopkins University.

APPENDICES.

APPENDIX A.

CONSTITUTION AND RULES OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may,

however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

SEC. 2. The officers of the Academy, together with six members to be elected by the Academy at the first stated session in each year, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

SEC. 3. The president of the Academy, or in case of his absence or inability to act the vice-president, shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The six additional members of the council shall be elected, on any day after the first of the first stated session in each year, by each voter inscribing six names on his ballot, and those six who have received more votes than any others shall be declared elected. If two or more names have received the lowest number of votes that would elect, additional balloting shall be had for as many members as remain each time to be elected until the number is full.

The term of the members so elected shall commence at the close of the session at which they are elected and continue until the close of the first stated session in the next year.

SEC. 4. Nominations of members may be made in writing, signed by any five members of the Academy, at any stated session, to be voted on at the next stated session held in Washington, and each nomination shall, at the time of election, be accompanied by a written list of the original works of the nominee.

SEC. 5. The Academy shall be divided into six standing committees. In this classification a member who is eminent in more than one subject may be assigned to a corresponding number of committees. The classification shall be the following:

1. Mathematics and Astronomy.
2. Physics and Engineering.
3. Chemistry.
4. Geology and Paleontology.
5. Biology.
6. Anthropology.

In nominating for membership in the Academy, a statement must be made as to the subject or subjects in which the person nominated is eminent. Every nomination must be submitted, through the secretary, to all the members of the committee or committees representing the

subject or subjects in which the person nominated is stated to be eminent; and in order that his name may be brought before the Academy for election he must receive the votes of a majority of the members of the committee or committees to which his name has been referred.

Elections for membership shall be held in the following manner: Each member may inscribe on a ballot not more than five names of nominees selected from the list. Absent members may send such ballots to the home secretary. From the seven names receiving the highest number of votes in this preference ballot the members present may proceed to elect new members in the following manner: At each ballot each member present may vote for not exceeding three persons, and the person receiving the highest number of votes shall be declared elected, provided that he receive two-thirds of the votes cast and that his name appear on not less than twenty ballots; and provided further, that the number of members of the Academy be not already one hundred or over, in which case to be declared to be elected he must receive four-fifths of the votes cast, and his name must appear on at least twenty-five ballots.

Should several candidates have the same minimum number of votes on the preference list, the requisite number for completing the list shall be selected from them by a two-thirds vote of the members present.

Election of members shall be held only at the regular stated session of each year held in Washington, and not more than five members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. Foreign associates may be nominated by a committee of five members, to be appointed for that purpose by the president and elected at any stated session by a two-thirds vote of the members present. The election shall be had by each member indicating on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the ballots shall be declared elected.

SEC. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the Academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

SEC. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council, and afterwards to the Academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy, upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with

the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

Sec. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

Sec. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

Article VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.

7. Other business.

8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of Departments of the Govern-

ment, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender. and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1902-1903.

	Expiration of term.
Agassiz, Alexander, *President*	April, 1907.
Hall, Asaph, *Vice-President*	April, 1903.
Remsen, Ira, *Foreign Secretary*	April, 1907.
Hague, Arnold, *Home Secretary*	April, 1907.
Emmons, S. F., *Treasurer*	April, 1908.

ADDITIONAL MEMBERS OF COUNCIL, 1902-1903.

Billings, J. S.
Bowditch, H. P.
Brush, G. J.
Newcomb, S.
Walcott, C. D.
Welch, W. H.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
   - Abbe, C.
   - Boss, L.
   - Campbell, W. W.
   - Chandler, S. C.
   - Comstock, G. C.
   - Davidson, G.
   - Elkin, W. L.
   - Hall, A.
   - Hale, G. E.
   - Hill, G. W.
   - Holden, E. S.
   - Langley, S. P.
   - Moore, E. H.
   - Newcomb, S.
   - Peirce, C. S.
   - Pickering, E. C.
   - Woodward, R. S.
   - Young, C. A.
2. Physics and Engineering.
   - Abbe, C.
   - Abbott, H. L.
   - Barker, G. F.
   - Barus, C.

2. Physics and Engineering—Continued.
   - Bell, A. G.
   - Comstock, C. B.
   - Gibbs, J. W.
   - Hastings, C. S.
   - Langley, S. P.
   - Mendenhall, T. C.
   - Michelson, A. A.
   - Morley, E. W.
   - Nichols, E. L.
   - Pickering, E. C.
   - Sellers, W.
   - Trowbridge, J.
   - Woodward, R. S.
   - Wright, A. W.
3. Chemistry.
   - Barker, G. F.
   - Brush, G. J.
   - Chandler, C. F.
   - Chittenden, R. H.
   - Crafts, J. M.
   - Dana, E. S.
   - Gibbs, W.
   - Gooch, F. A.

COMMITTEES OF THE ACADEMY—Continued.

On nominations of new members—Continued.

3. Chemistry—Continued.
   - Hilgard, E. W.
   - Hill, H. B.
   - Jackson, C. L.
   - Johnson, S. W.
   - Michael, A.
   - Morley, E. W.
   - Penfield, S. L.
   - Remsen, I.
   - Richards, T. W.
   - Smith, E. F.
4. Geology and Paleontology.
   - Agassiz, A.
   - G. F.
   - Beecher, C. E.
   - Dall, W. H.
   - Dutton, C. E.
   - Emmons, S. F.
   - Gilbert, G. K.
   - Hague, Arnold.
   - Lesley, J. P.
   - Osborn, H. F.
   - Packard, A. S.
   - Penfield, S. L.
   - Pumpelly, R.
   - Van Hise, C. R.
   - Walcott, C. D.
   - White, C. A.
5. Biology.
   - Agassiz, A.
   - Allen, J. A.
   - Bowditch, H. P.
   - Brewer, W. H.
   - Brooks, W. K.

5. Biology—Continued.
   - Chittenden, R. H.
   - Dall, W. H.
   - Farlow, W. G.
   - Gill, T. N.
   - Goodale, G. L.
   - Merriam, C. H.
   - Minot, C. S.
   - Morse, E. S.
   - Osborn, H. F.
   - Packard, A. S.
   - Prudden, T. M.
   - Putnam, F. W.
   - Sargent, C. S.
   - Scudder, S. H.
   - Smith, S. I.
   - Trelease, W.
   - Verrill, A. E.
   - Walcott, C. D.
   - Welch, W. H.
   - White, C. A.
   - Whitman, C. O.
   - Wilson, E. B.
   - Wood, H. C.
6. Anthropology.
   - Billings, J. S. ✓
   - Boas, F.
   - Cattell, J. McK.
   - Minot, C. S.
   - Mitchell, S. W. ✓
   - Morse, E. S. ✓
   - Peirce, C. S. ✓
   - Putnam, F. W.
   - Welch, W. H. ✓

On Weights, Measures, and Coinage.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Newcomb, S.
Young, C. A.
Peirce, C. S.
Sellers, Wm.
Comstock, C. B.

On the Election of Foreign Associates.

Remsen, Ira, *Chairman.*
Hall, A.
Mitchell, S. W.
Newcomb, S.

On Publication.

The President.
C. D. Walcott.
The Home Secretary.

TRUST FUNDS.

Board of Direction of the Bache Fund.

Gibbs, Wolcott, *Chairman.*
Chandler, S. C.
Scudder, S. H.

Board of Trustees of the Watson Fund.

Newcomb, S., *Chairman.*
Hall, A.
Boss, L.

The Henry Draper Fund.

Pickering, E. C., *Chairman.*
Newcomb, S.
Trowbridge, J.
Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

Brush, G. J., *Chairman.*
Morley, E. W.
Johnson, S. W.
Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

Hall, Asaph, *Chairman.*
Chandler, S. C.
Boss, Lewis.

The Barnard Medal.

Billings, J. S., *Chairman.*
Bowditch, H. P.
Chandler, S. C.
Jackson, C. L.
Newcomb, S.
Sellers, Wm.

The Wolcott Gibbs Fund.

Jackson, C. L., *Chairman.*
Remsen, Ira.
Drown, T. M.

The Joseph Henry Fund.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others, as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, JANUARY 20, 1903.

		Date of election.
Abbe, Cleveland	*2017 I st., NW., Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum, New York City.*	1876
Barker, George F	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Brown University, Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Beecher, Charles E	*Yale University Museum, New Haven, Conn.*	1899
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Bowditch, Henry P	*Jamaica Plain, Mass.*	1887
Brewer, William H	*418 Orange st., New Haven, Conn.*	1880
Brooks, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
Brush, George J	*14 Trumbull st., New Haven, Conn.*	1868
Campbell, William W	*Lick Observatory, Mt. Hamilton, California.*	1902
Cattell, James McK	*Garrison, New York.*	1901
Chandler, Charles F	*Columbia University, New York City.*	1874
Chandler, Seth C	*16 Craigie st., Cambridge, Mass.*	1888
Chittenden, Russell H	*New Haven, Conn.*	1890
Comstock, Cyrus B., U. S. A	*124 E. Twenty-seventh st., New York City.*	1884
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Crafts, James M	*88 Marlborough st., Boston, Mass.*	1872
Dall, William H	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S	*Yale University, New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Dutton, Clarence E., U. S. A	*San Antonio, Texas.*	1884
Elkin, William L	*Yale University Observatory, New Haven, Conn.*	1895
Emmons, Samuel F	*U. S. Geological Survey, Washington, D. C.*	1892
Farlow, W. G	*Harvard University, Cambridge, Mass.*	1879
Gibbs, Josiah Willard	*Yale University, New Haven, Conn.*	1879
Gibbs, Wolcott	*Newport, R. I.*	——
Gilbert, Grove K	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A	*Yale University, New Haven, Conn.*	1897
Goodale, George L	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E	*Yerkes Observatory, Williams Bay, Wis.*	1902
Hall, Asaph	*South Norfolk, Conn.*	1875
Hastings, Charles S	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W	*University of California, Berkeley, Cal.*	1872
Hill, George W	*West Nyack, N. Y.*	1874
Hill, Henry B	*Harvard University, Cambridge, Mass.*	1883
Holden, Edward S	*U. S. Military Academy, West Point, N. Y.*	1885
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
Johnson, Samuel W	*54 Trumbull st., New Haven, Conn.*	1866
Langley, Samuel P	*Smithsonian Institution, Washington, D. C.*	1876
Lesley, J. Peter	*Milton, Mass.*	——
Mendenhall, Thomas C	*Worcester, Mass.*	1887

		Date of election.
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H	*University of Chicago, Chicago, Ill.*	1901
Morley, Edward W	*2238 Euclid ave., Cleveland Ohio.*	1897
Morse, Edward S	*P. O. Box 268, Salem, Mass.*	1876
Newcomb, Simon, U. S. N	*1620 P st. NW., Washington, D. C.*	1869
Nichols, Edward L	*Cornell University, Ithaca, N. Y.*	1901
Osborn, H. F	*American Museum of Natural History, New York City.*	1900
Packard, A. S	*275 Angell st., Providence, R. I.*	1872
Peirce, Charles S	*Milford, Pa.*	1876
Penfield, S. L	*Yale University, New Haven, Conn.*	1900
Pickering, Edward C	*Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Putnam, Frederick W	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W	*Harvard University, Cambridge, Mass.*	1899
Sargent, Charles S	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scudder, Samuel H	*Cambridge, Mass.*	1877
Sellers, William	*1819 Vine st., Philadelphia, Pa.*	1873
Smith, Edgar F	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Sidney I	*Yale University, New Haven, Conn.*	1884
Trelease, Wm	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D	*U. S. Geological Survey, Washington, D. C.*	1896
Welch, William H	*935 St. Paul st., Baltimore, Md.*	1895
Write, Charles A	*330 T st. NW., Washington, D. C.*	1889
Whitman, Charles O	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B	*Columbia University, New York City.*	1899
Wood, Horatio C	*1925 Chestnut st., Philadelphia, Pa.*	1879
Woodward, Robert S	*Columbia University, New York City.*	1896
Wright, Arthur W	*Yale University, New Haven, Conn.*	1881
Young, Charles A	*Princeton University, Princeton, N. J.*	1872

DECEASED MEMBERS.

	Date of death.
*Agassiz, Louis	Dec. 14, 1873
*Alexander, J. H	Mar. 2, 1867
*Alexander, Stephen	June 25, 1883
*Bache, Alexander Dallas	Feb. 14, 1867
*Baird, Spencer F	Aug. 19, 1887
Barnard, F. A. P	Apr. 27, 1889
*Barnard, J. G	May 14, 1882
Bartlett, W. H. C	Feb. 11, 1893
*Brown-Sequard, Charles E	Apr. 2, 1894
*Casey, Thomas L	Mar. 25, 1896

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*Biographical notices have been presented of those designated by an asterisk.

	Date of death.
* Caswell, Alexis	Jan. 8, 1887
* Chauvenet, William	Dec. 13, 1870
* Clarke, Henry James	July 1, 1873
* Coffin, James H	Jan. 6, 1873
* Coffin, J. H. C	Jan. 8, 1890
* Cook, George H	Sept. 22, 1889
* Cooke, Josiah P	Sept. 3, 1894
* Cope, Edward D	Apr. 12, 1897
Coues, Elliott	Dec. 25, 1899
* Dalton, J. C	Feb. 2, 1889
Dana, James D	Apr. 14, 1895
* Davis, Charles H	Feb. 14, 1877
* Draper, Henry	Nov. 20, 1882
* Draper, John W	Jan. 4, 1882
* Eads, James B	Mar. 8, 1887
* Engelman, George	Feb. 4, 1884
* Ferrel, William	Sept. 18, 1891
* Frazer, John Fries	Oct. 12, 1872
* Gabb, William M	May 30, 1878
* Genth, F. A	Feb. 2, 1893
* Gilliss, James Melville	Feb. 9, 1865
* Goode, G. Brown	Sept. 6, 1896
* Gould, Augustus A	Sept. 15, 1866
Gould, Benjamin A	Nov. 27, 1896
* Gray, Asa	Jan. 30, 1888
* Guyot, Arnold	Feb. 8, 1884
* Hadley, James	Aug. 1, 1864
* Haldeman, S. S	Sept. 20, 1880
Hall, James	Aug. 8, 1898
* Hayden, F. V	Dec. 22, 1887
* Henry, Joseph	May 13, 1878
* Hilgard, Julius E	May 8, 1891
* Hitchcock, Edward	Feb. 27, 1864
* Holbrook, J. E	Sept. 8, 1871
* Hubbard, J. S	Aug. 16, 1863
* Humphreys, A. A	Nov. 28, 1883
Hunt, T. Sterry	Feb. 12, 1892
Hyatt, Alpheus	Jan. 16, 1902
Keeler, J. E	Aug. 12, 1900
King, Clarence	Dec. 24, 1901
* Kirkland, Jared P	Dec. 10, 1877
* Lane, J. Homer	May 3, 1880
* Le Conte, John	Apr. 29, 1891
* Le Conte, John L	Nov. 15, 1883
Le Conte, Joseph	July 6, 1901
Lea, Matthew C	Mar. 15, 1897
Leidy, Joseph	Apr. 30, 1891
* Lesquereux, Leo	Oct. 25, 1889
Longstreth, Miers F	Dec. 27, 1891
* Loomis, Elias	Aug. 16, 1889
Lovering, Joseph	Jan. 18, 1892
Lyman, Theodore	Sept. 10, 1897

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* Biographical notices have been presented of those designated by an asterisk.

	Date of death.
* Mahan, D. H	Sept. 16, 1871
* Marsh, G. P	July 23, 1882
Marsh, O. C	Mar. 18, 1899
Mayer, Alfred M	July 13, 1897
Mayo-Smith, Richmond	Nov. 11, 1901
* Meek, F. B	Dec. 21, 1877
* Meigs, M. C	Jan. 2, 1892
Mitchell, Henry	Dec. 1, 1902
* Morgan, Lewis H	Dec. 14, 1881
Morton, Henry	May 9, 1902
* Newberry, J. S	Dec. 7, 1892
* Newton, H. A	Aug. 1, 1896
* Newton, John	May 1, 1895
* Norton, William A	Sept. 21, 1883
* Oliver, James E	Mar. 27, 1895
Peters, C. H. F	July 18, 1890
* Pourtales, L. F	July 19, 1880
Powell, John W	Sept. 23, 1902
Rodgers, John	May 5, 1882
Rogers, Fairman	Aug. 23, 1900
Rogers, Robert E	Sept. 7, 1884
* Rogers, Wm. A	Mar. 1, 1898
* Rogers, William B	May 30, 1882
Rood, Ogden N	Nov. 12, 1902
* Rowland, Henry A	Apr. 16, 1901
* Rutherfurd, Lewis M	May 30, 1892
* Saxton, Joseph	Oct. 26, 1873
Schott, Charles A	July 31, 1901
* Silliman, Benj., Sr	Nov. 24, 1864
Silliman, Benj., Jr	Jan. 14, 1885
* Smith, J. Lawrence	Oct. 12, 1883
* Stimpson, William	May 26, 1873
* Strong, Theodore	Feb. 1, 1869
* Sullivant, W. S	Apr. 30, 1873
* Torrey, John	Mar. 10, 1873
* Totten, J. G	Apr. 22, 1864
* Trowbridge, William P	Aug. 12, 1892
Trumbull, James H	Aug. 5, 1897
* Tuckerman, Edward	Mar. 15, 1886
* Walker, Francis A	Jan. 5, 1897
* Warren, G. K	Aug. 8, 1882
* Watson, James C	Nov. 23, 1880
* Watson, Sereno	Mar. 9, 1892
* Winlock, Joseph	June 11, 1875
* Woodward, J. J	Aug. 17, 1884
* Worthen, A. H	May 6, 1888
* Wyman, Jeffries	Sept. 4, 1874

FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Baeyer, Adolph (Ritter von)	*Munich.*
Berthelot, M. P. E	*Paris.*

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* Biographical notices have been presented of those designated by an asterisk.

Bornet, Edouard	*Paris.*
Gegenbäur, Karl	*Heidelberg.*
Geikie, Sir Archibald	*London.*
Gill, David	*Cape Town.*
Hoff, J. H. van't	*Berlin.*
Hooker, Sir J. D	*London.*
Janssen, J	*Paris.*
Kelvin (Lord)	*London.*
Klein, Felix	*Göttingen.*
Kohlrausch, Friedrich	*Berlin.*
Kölliker, Albert von	*Würzburg.*
Kronecker, Hugo	*Bern.*
Lister (Lord)	*London.*
Loewy, Maurice	*Paris.*
Moissan, Henri	*Paris.*
Poincaré, Henri	*Paris.*
Rayleigh (Lord)	*London.*
Richthofen, F. von	*Berlin.*
Stokes, Sir George G	*Cambridge.*
Strasburger, Edouard	*Bonn.*
Struve, Otto von	*Karlsruhe.*
Suess, Edouard	*Vienna.*
Zittel, Karl Alfred (Ritter von)	*Munich.*

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.
C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.
Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekulé.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.
Henri de Lacaze-Duthiers.
Alfred Cornu.
Rudolph von Virchow.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCE

FOR

THE YEAR 1903.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

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LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE PAST YEAR, 1903.

National Academy of Sciences,
Office of the President,
Washington, D. C., January 2, 1904.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

Alexander Agassiz.

The President of the Senate.

ACT OF INCORPORATION.

AN ACT to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherfurd, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT to amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882.*

True copies.

SEVELLON A. BROWN,
Chief Clerk.

AN ACT to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN,
Chief Clerk.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1903 the Academy held three sessions. The first was the regular annual session, held at Washington April 21 to 23, inclusive; the second, a scientific session, held at Chicago November 17 and 18; the third, a special session, held at Chicago November 18, for the transaction of business.

ANNUAL MEETING.

The session was held at the U. S. National Museum, Washington, with the president, Mr. Alexander Agassiz, in the chair.

The following members were present during the session: Messrs. Abbe, Abbot, Agassiz, Barker, Barus, Becker, Bell, Billings, Boas, Boss, Bowditch, Brewer, Brooks, Brush, Cattell, Chandler (C. F.), Crafts, Dall, Emmons, Gilbert, Gill, Hague, Hale, Hall, Hill, Merriam, Mitchell, Moore, Morse, Newcomb, Peirce, Penfield, Remsen, Sellers, Welch, White, Wood, and Woodward.

REPORT OF THE HOME SECRETARY.

The President of the National Academy of Sciences:

I have the honor to present herewith my report as home secretary of the National Academy of Sciences for the year ending April 20, 1903.

The annual report of the president for 1902 was transmitted to Congress January 20, 1903, through Senator Wetmore, of Rhode Island, chairman of the Committee on the Library, and the customary edition of 500 copies was received from the Public Printer February 12. About 100 copies were distributed to members of the Academy, and an equal number mailed to the foreign associates and the principal libraries of the United States.

The Seventh Memoir of Volume VIII (West Indian Madreporarian Polyps), by J. E. Duerden, has been printed, although but a portion of the edition has been received, most of which has been distributed to members of the Academy and to libraries on the exchange list.

Three biographical memoirs have been printed during the past year, a memoir of Joseph Henry, by Simon Newcomb; a memoir of Joseph Edwards Holbrook, by Theodore Gill; a memoir of L. F. de Pourtales, by Alexander Agassiz. Several other memoirs are now in the hands of the home secretary, and will appear in the fifth volume of the Biographical Memoirs of the Academy.

There has been an increased demand for the publications of the Academy, especially for the volume of Professor Atwater, entitled "An Experimental Inquiry regarding the Nutritive Value of Alcohol." During the year 50 complete sets of the Biographical Memoirs, Volumes I to IV, inclusive, have been sent to prominent libraries of the country. This distribution has led to a demand for these memoirs by other libraries, but only Volumes III and IV could be supplied. Large additions have been made to the library of the Academy from time to time, mainly from learned societies, and these publications have been stored as heretofore in the Smithsonian building, upon shelves set apart for the use of the Academy.

At the time of the last annual meeting, in April, 1902, there were 87 names on the active membership list of the Academy. At the annual meeting five new members were elected, but during the year five members have been removed by death, leaving the membership list at 87, where it stood last year. The foreign associates number 26.

Very respectfully,

ARNOLD HAGUE, *Home Secretary.*

APRIL 20, 1903.

REPORT OF THE TREASURER.

WASHINGTON, D. C., *April 21, 1903.*

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 21, 1903.

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	Smith fund.	Gould fund.	Emmons and Gill, trustees.	Building fund.
Balance brought forward:								
Cash	$1,157.86	$1,992.86	$1,740.95	$1,515.99	$537.56	$543.89	$420.13	$500.00
Invested income	2,500.00	1,000.00	2,993.71		1,496.57	1,000.00		1,000.00
Interest	273.15	2,164.48	1,148.12	368.20	364.58	935.00	225.00	73.61
Members' tax	495.00							
Appropriation returned		34.30						
Total	4,426.01	5,191.64	5,882.78	1,884.19	2,398.71	2,478.89	645.13	1,573.61
Disbursed	414.41	1,859.95	1,303.46	711.52	323.01	454.63	43.02	6.66
Balance:								
Cash	1,511.60	2,331.69	1,585.61	1,172.67	579.13	1,024.26	602.11	66.95
Invested income	2,500.00	1,000.00	2,993.71		1,496.57	1,000.00		1,500.00
Total accounted for	4,426.01	5,191.64	5,882.78	1,884.19	2,398.71	2,478.89	645.13	1,573.61

Very respectfully,

S. F. EMMONS, *Treasurer.*

The treasurer's report was referred to an auditing committee, consisting of Messrs. Gill, Dall, and Gilbert, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer.

Theo. Gill.
Wm. H. Dall.

REPORT OF TRUST FUNDS.

REPORT OF THE BOARD OF DIRECTION OF THE BACHE FUND FOR THE ACADEMY YEAR 1902–3.

The board of directors of the Bache fund present, as a matter of courtesy to the academy, the following statement of their operations since the last stated meeting of the academy in April, 1902.

During the academy year two changes have occurred in the board, through the resignations of Prof. S. H. Scudder, in April, 1902, and of Dr. Wolcott Gibbs, in February, 1903. The vacancies thus caused were filled by the remaining members of the board by the appointment of Dr. H. P. Bowditch and Dr. Ira Remsen.

The following appropriations have been made by the board since April, 1902:

1902.		
Dec. 9.	To Prof. Lewis Boss, for assistance in publishing results of his investigation of standard stars	$300
1903.		
Mar. 2.	To Prof. Simon Newcomb, for statistical investigation on the cause of sex in human offspring	50
Apr. 2.	To Prof. R. H. Chittenden, for study of the minimum proteid requirement in healthy men	1,000

Respectfully submitted.

S. C. Chandler.
H. P. Bowditch.
Ira Remsen.

REPORT OF THE DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND FOR THE ACADEMY YEAR 1902-3.

The directors of the Benjamin Apthorp Gould fund respectfully submit the following report:

The following appropriations have been made since the last stated meeting of the Academy, April, 1902:

1902.		
Dec. 30.	To Prof. H. A. Peck, for definitive computations of cometary orbits..	$100
1903.		
Apr. 14.	To Prof. W. W. Payne, for computer to assist Dr. H. G. Wilson in reduction of Eros photographs for the solar parallax (second appropriation)	250
Apr. 14.	To Prof. F. P. Leavenworth, for assistance in reduction of Eros photographs for the solar parallax (second appropriation)	200
Apr. 14.	To Prof. George C. Comstock, for assistance in reduction of A. S. Flint's meridian observations for determination of stellar parallaxes	400

With regard to the appropriation of $300 (of 1902, April 1) mentioned in our previous report as granted to Professor Payne, it should be stated that it was afterwards divided between Carleton College Observatory and Prof. F. P. Leavenworth, of the University of Minnesota, equally, or $150 to each.

In March, 1903, the board renewed its offer to American astronomers of $500, to be distributed in amounts subsequently to be allotted by the board, for the computation of definitive orbits of comets.

Respectfully submitted.

Asaph Hall.
Lewis Boss.
Seth C. Chandler.

REPORT OF THE COMMITTEE ON THE WOLCOTT GIBBS FUND.

The committee on the Wolcott Gibbs fund for chemical research has the honor to report that the income of the fund is to be paid to Dr. Wolcott Gibbs, according to the vote passed when the fund was established.

Very respectfully,

Charles L. Jackson, *Chairman.*

REPORT OF WORK ON THE WATSON TRUST.

Under the arrangement with Professor Leuschner, of the University of California, which was reported at the last annual session of the Academy, the work of making tables of the asteroids discovered by James C. Watson has made very satisfactory progress. The general perturbations, the computation of which is the most difficult part of the work, have been computed for 17 of the 22 asteroids in question; but some of these computations still need revision. Of the remaining five, three required the application of Bohlin's method, tables for applying which have been computed under the direction of Professor Leuschner. Another planet, Æthra, has never been seen since the first opposition, and work on its tables can not be commenced until it is rediscovered. Work on the remaining one, Thyra, has been postponed.

The following particulars as to the principal and income of the fund have been supplied by the treasurer of the Academy:

Invested capital	$22,000.00
Invested income	2,993.71
Uninvested income on hand	1,537.61

The annual income varies according to the rate of interest received, and will probably be in the future between $900 and $1,000.

Respectfully submitted.

S. Newcomb.

REPORT OF THE HENRY DRAPER COMMITTEE, 1902–3.

During the past year the Henry Draper committee has recommended to the Academy that the Henry Draper medal be awarded to Prof. George E. Hale, director of the Yerkes Observatory, for his investigations in astronomical physics. An appropriation of $351 has also been made to Prof. W. W. Campbell, director of the Lick Observatory, for a micrometer microscope for measuring photographs.

In the last report of the treasurer the accumulated interest of the Henry Draper fund amounted to $1,515.99, which is equal to the annual income for four years. No applications for aid to research are now before the committee. In view of the numerous urgent needs of astronomers for aid in their work, it is unfortunate that some better system does not exist by which the accumulations of the Henry Draper and other similar research funds can be expended to the best advantage. Some system of cooperation is recommended by which the income of the various funds for research may be employed as desired by those who established them.

Respectfully submitted.

Edward C. Pickering, *Chairman.*
A. A. Michelson.
Simon Newcomb.
John Trowbridge.
Arthur W. Wright.

ELECTION OF OFFICERS.

Mr. Ira Remsen was elected vice-president of the Academy in place of Mr. Asaph Hall, resigned.

Mr. Simon Newcomb was elected foreign secretary.

Messrs. Billings, Bowditch, Brush, Walcott, Welch, and Hale were elected members of the council.

ELECTION OF MEMBERS.

Messrs. Thomas C. Chamberlin, William James, Edward L. Mark, Arthur G. Webster, and Horace L. Wells were elected members of the Academy.

ELECTION OF FOREIGN ASSOCIATES.

The following-named gentlemen were elected foreign associates of the Academy: Messrs. Emile Ricard and E. J. Marey, of Paris; Robert Koch and H. C. Vogel, of Berlin; Wilhelm Pfeffer and Ferdinand Zirkel, of Leipzig; Joseph John Thomson, of Cambridge; E. Ray Lankester, of London; Oskar Backlund, of Pulkowa; Dmitri I. Mendeleeff, of St. Petersburg, and W. C. Brögger, of Christiania.

APPOINTMENTS.

Mr. W. L. Elkin was appointed by the Academy a trustee of the Watson fund in place of Mr. Asaph Hall, resigned.

The president appointed Mr. G. J. Brush a member of the committee on the election of foreign associates in place of Mr. S. Newcomb, whose election as foreign secretary made him ex officio chairman of that committee.

DEATHS.

Four members of the Academy died since the last autumn meeting. Henry Mitchell died on the 1st of December, 1902; Henry B. Hill, April 6, 1903; J. Willard Gibbs, April 28; and J. Peter Lesley, June 3, 1903.

Of the foreign associates, Sir George G. Stokes died in Cambridge February 1, and Karl Gegenbaur in Heidelberg, June 14, 1903.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

An Estimate of the Weight of the Skeleton in the Sauropoda, or in the Sauropodous Dinosaurs. Henry F. Osborn.

New Characters of the Skulls of Carnivorous and Herbivorous Dinosaurs. Henry F. Osborn.

Models illustrating the Evolution of the Amblypoda, also of the Dinosaur *Diplodocus*, together with a Theory as to the Habits of the Sauropoda. Henry F. Osborn.

Radioactivity of Thorium Minerals. George F. Barker.

The Law of Catalysis in Concentrated Solutions. J. M. Crafts.

The Standardization of Thermometric Measurements. J. M. Crafts.

The Rumford Spectroheliograph of the Yerkes Observatory. George E. Hale.

The Determination of Standard Right-ascensions free from the Personal Equation for Star-magnitude. Lewis Boss. (With stereopticon illustrations.)

On the Semi-diurnal Tide of the Northern Part of the Indian Ocean. R. A. Harris. (Introduced by Cleveland Abbe.)

The Melting Point of a Simple Glass. Arthur L. Day. (Introduced by G. F. Becker.)

Biographical Memoir of J. E. Holbrook. Theodore Gill.

Biographical Memoir of Matthew Carey Lea. George F. Barker.

Biographical Memoir of Clarence King. S. F. Emmons.

Biographical Memoir of A. A. Gould. Jeffries Wyman. Read by W. H. Dall.

Biographical Memoir of James E. Keeler. Charles S. Hastings.

The Diffusion of Vapor into Nucleated Air. Carl Barus.

Biographical Memoir of Theodore Lyman. H. P. Bowditch.

The Nomenclature of the Topography of the Bottom of the Oceans. Alexander Agassiz.

On the Discovery of an Antidote for Rattlesnake Poison. S. Weir Mitchell.

On the Tetrahedral Principle in Kite Structure. A. G. Bell.

GOVERNMENT BUSINESS.

The president read the following letter from the Secretary of State:

DEPARTMENT OF STATE,
Washington, April 14, 1903.

ALEXANDER AGASSIZ, Esq.,
President National Academy of Sciences, Cambridge, Mass.

SIR: In accordance with the provisions of section 3 of the act incorporating the National Academy of Sciences, I desire to invite the attention of the National Academy of Sciences to the condition of the Declaration of Independence, and to suggest that a committee be appointed to examine it in the library of this Department, and that such recommendations as may seem practicable be made to me touching its preservation. It is now kept out of the light, sealed between two sheets of glass, presumably proof against air, and locked in a steel safe. I am unable to say, however, that, in spite of these precautions, observed for the past ten years, the text is not continuing to fade and the parchment to wrinkle and perhaps to break.

I am, sir, yonr obedient servant, JOHN HAY.

The president appointed a committee to consider the matter, consisting of Messrs. C. F. Chandler, Billings, and Remsen, whose conclusions will be found embodied in the following letter to the Secretary of State:

NEW YORK, *April 24, 1903.*

Hon. JOHN HAY, *Secretary of State.*

DEAR SIR: In response to a communication received from you, a committee was appointed by President Agassiz, of the National Academy of Sciences, to confer with you with regard to the present condition of the Declaration of Independence, and to make such recommendations as should seem desirable to insure the preservation of this precious instrument. The committee was also requested to send their report to you directly, in order to avoid the delay which might result from reporting in the usual manner to the officers of the Academy. The members of the committee are John S. Billings, Ira Remsen, and Charles F. Chandler.

After conferring with you, the committee was given an opportunity to make a careful examination of the instrument, with the assistance of Mr. A. H. Allen, Chief of the Bureau of Rolls and Library, and with the assistance of Dr. Wilbur M. Grey, of the Army Medical Museum.

The instrument has suffered very seriously from the very harsh treatment to which it was exposed in the earlier years of the Republic. Folding and rolling have creased and broken the parchment. The wet press-copying operation, to which it was exposed about 1820, for the purpose of producing a facsimile copy, removed a large portion of the ink. Subsequent exposure to the action of light for more than thirty years, while the instrument was placed on exhibition, has resulted in the fading of the ink, particularly in the signatures. The present method of caring for the instrument seems to be the best that can be suggested.

The committee is pleased to find that no evidence of mold or other disintegrating agents can be discovered upon the parchment by careful microscopic examination, nor any evidence that disintegration is now in progress.

The investigation has been facilitated by the photograph that was taken in 1883, two years after the previous examination by a committee of the Academy, and we would suggest the desirability of taking another photograph of about the same size, at the present time, and from time to time in the future, as an aid to future investigations.

The committee does not consider it wise to apply any chemicals with a view to restoring the original color of the ink, because such application could be but partially successful, as a considerable percentage of the original ink was removed in making the copy about 1820, and also because such application might result in serious discoloration of the parchment; nor does the committee consider it necessary or advisable to apply any solution, such as collodion, paraffin, etc., with a view to strengthening the parchment or making it moisture proof.

The committee is of the opinion that the present method of protecting the instrument should be continued; that it should be kept in the dark, and as dry as possible, and never placed on exhibition.

Very respectfully, yours,

Charles F. Chandler,
Chairman of the Committee.

Secretary Hay replied to this letter as follows:

Department of State,
Washington, April 27, 1903.

Prof. C. F. Chandler,
Chairman Committee of the National Academy of Sciences to examine the present condition of the Declaration of Independence.

Sir: I have received your letter of April 24 instant, conveying the report of the committee appointed by President Agassiz of the National Academy of Sciences to confer with me respecting the present condition of the Declaration of Independence, and I beg you to accept for yourself and your colleagues of the committee—President Remsen, of the Johns Hopkins University, and Dr. Billings, of the New York Public Library—my thanks for the promptness and thoroughness of the examination made by the committee, among the results of which is the gratifying assurance that no evidence of mold or other disintegrating agents were discovered upon the parchment under the microscope. I am gratified also to learn that the present method of caring for the instrument meets the concurrence of the committee.

The suggestions and recommendations made by yourself and your colleagues will be attentively observed by the Department, and I have already caused your advice to be followed by securing a photograph for comparison with that of 1883, and with others to be taken hereafter, from time to time, as aids to future investigations.

The conclusions of the committee, that the application of any chemicals with the view of restoring the original color of the ink would be unwise, and that the application of any solution, such as collodion, paraffin, etc., is neither necessary nor advisable for the purpose of strengthening the parchment or making it moisture proof, are welcome as avoiding experimental treatment of a document so precious and historic.

Again thanking the committee for their attention and care,

I am, sir, your obedient servant,

JOHN HAY.

The president announced the appointment of Mr. Simon Newcomb to attend a meeting of the council of the International Association of Academies in the rooms of the Royal Society of London, on Thursday, June 4.

He also announced that Messrs. Emmons, Van Hise, and Becker had been appointed delegates to represent the Academy at the International Geological Congress to be held at Vienna, beginning August 27.

AUTUMN MEETING OF THE ACADEMY.

SCIENTIFIC SESSION.

[Held in Chicago November 17 and 18, 1903.]

A scientific session for the reading of papers having been called by the council, the Academy met in the Haskell Oriental Museum of the University of Chicago, Chicago, November 17 and 18, 1903.

President Agassiz presided at the sessions, and the following members were in attendance: Messrs. Bowditch, Brewer, Cattell, Chamberlin, Comstock (G. C.), Dutton, Hague, Hale, Michelson, Moore, Van Hise, Webster, and Whitman.

The following papers were presented:

Preliminary Report on the Agassiz Data relative to Underground Temperatures at the Calumet and Hecla Mine. T. C. Chamberlin.

The Velocities of Earthquake Vibrations and their Significance. C. E. Dutton.

The Relation between Solution Tension and Physiological Action of the Elements. A. P. Mathews. (Introduced by C. O. Whitman.)

On the Distribution and Classification of the Plesiosaurs. S. W. Williston. (Introduced by T. C. Chamberlin.)

The Evolution of the Wing-Bars in Pigeons. C. O. Whitman.

Evolution without Mutation. Chas. B. Davenport. (Introduced by C. O. Whitman.)

The Measurement of Scientific Merit. J. McK. Cattell.

Stereoisomeric Nitrogen Compounds. J. Stieglitz. (Introduced by A. A. Michelson.)

On the Recent Investigations of the Rare Earths in the Laboratory of the University of North Carolina. Charles Baskerville. (Introduced by Ira Remsen.)

Some Peculiarities of Comets' Tails, and Their Probable Explanation. E. E. Barnard. (Introduced by George E. Hale.)

Stars of the Orion Class. Edwin B. Frost. (Introduced by George E. Hale.)

On the Nature of the Solar Flocculi. George E. Hale.

The Relation of Stellar Magnitude to Stellar Distances. Geo. C. Comstock.

Spectra of Imperfect Gratings. A. A. Michelson.

The Relations of Weight and Energy. Stephen Moulton Babcock. (Introduced by Charles R. Van Hise.)

The Propagation of Ground Water Waves. C. S. Slichter. (Introduced by Geo. C. Comstock.)

Biographical Memoir of Sereno Watson. William H. Brewer.

The International Geological Congress and a Geophysical Laboratory. Charles R. Van Hise.

BUSINESS MEETING.

[Chicago, November 17, 1903.]

A business meeting of the Academy, called by the council to consider the president's report to Congress and such other business as might be presented, was held November 17, with the president, Mr. Alexander Agassiz, in the chair.

The Academy adopted a motion that the president should make his annual report to Congress in the usual form.

The home secretary presented a report from Mr. Simon Newcomb, chairman of the Watson trustees, which was referred to the treasurer, Mr. S. F. Emmons, with the request that he report on the same at the next annual meeting of the Academy in April, 1904.

INTERNATIONAL ASSOCIATION OF ACADEMIES.

The president made the following statement: At the council meeting of the International Association of Academies in June last, our Academy was represented by Mr. Newcomb. Among the measures approved was a resolution proposed by the Accademia dei Lincei and supported by the National Academy of Sciences that the physiological laboratory on Monte Rosa be considered an international institution and worthy of recognition by the association on the ground of the importance of its work to science.

APPENDICES.

APPENDIX A.

CONSTITUTION AND RULES OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may,

however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

SEC. 2. The officers of the Academy, together with six members to be elected by the Academy at the first stated session in each year, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

SEC. 3. The president of the Academy, or in case of his absence or inability to act the vice-president, shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The six additional members of the council shall be elected, on any day after the first of the first stated session in each year, by each voter inscribing six names on his ballot, and those six who have received more votes than any others shall be declared elected. If two or more names have received the lowest number of votes that would elect, additional balloting shall be had for as many members as remain each time to be elected until the number is full.

The term of the members so elected shall commence at the close of the session at which they are elected and continue until the close of the first stated session in the next year.

SEC. 4. Nominations of members may be made in writing, signed by any five members of the Academy, at any stated session, to be voted on at the next stated session held in Washington, and each nomination shall, at the time of election, be accompanied by a written list of the original works of the nominee.

SEC. 5. The Academy shall be divided into six standing committees. In this classification a member who is eminent in more than one subject may be assigned to a corresponding number of committees. The classification shall be the following:

1. Mathematics and Astronomy.
2. Physics and Engineering.
3. Chemistry.
4. Geology and Paleontology.
5. Biology.
6. Anthropology.

In nominating for membership in the Academy, a statement must be made as to the subject or subjects in which the person nominated is eminent. Every nomination must be submitted, through the secretary, to all the members of the committee or committees representing the

subject or subjects in which the person nominated is stated to be eminent; and in order that his name may be brought before the Academy for election he must receive the votes of a majority of the members of the committee or committees to which his name has been referred.

Elections for membership shall be held in the following manner: Each member may inscribe on a ballot not more than five names of nominees selected from the list. Absent members may send such ballots to the home secretary. From the seven names receiving the highest number of votes in this preference ballot the members present may proceed to elect new members in the following manner: At each ballot each member present may vote for not exceeding three persons, and the person receiving the highest number of votes shall be declared elected, provided that he receive two-thirds of the votes cast and that his name appear on not less than twenty ballots; and provided further, that the number of members of the Academy be not already one hundred or over, in which case to be declared to be elected he must receive four-fifths of the votes cast, and his name must appear on at least twenty-five ballots.

Should several candidates have the same minimum number of votes on the preference list, the requisite number for completing the list shall be selected from them by a twó-thirds vote of the members present.

Election of members shall be held only at the regular stated session of each year held in Washington, and not more than five members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. Foreign associates may be nominated by a committee of five members, to be appointed for that purpose by the president and elected at any stated session by a two-thirds vote of the members present. The election shall be had by each member indicating on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the ballots shall be declared elected.

SEC. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the Academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

SEC. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council, and afterwards to the Academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy, upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with

the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

SEC. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.

7. Other business.

8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of Departments of the Govern-

ment, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1903–4.

	Expiration of term.
Agassiz, Alexander, *President*	April, 1907.
Remsen, Ira, *Vice-President*	April, 1909.
Newcomb, Simon, *Foreign Secretary*	April, 1909.
Hague, Arnold, *Home Secretary*	April, 1907.
Emmons, S. F., *Treasurer*	April, 1908.

ADDITIONAL MEMBERS OF COUNCIL, 1903–4.

Billings, J. S.
Bowditch, H. P.
Brush, G. J.
Hale, George E.
Walcott, C. D.
Welch, W. H.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
   - Abbe, C.
   - Boss, L.
   - Campbell, W. W.
   - Chandler, S. C.
   - Comstock, G. C.
   - Davidson, G.
   - Elkin, W. L.
   - Hall, A.
   - Hale, G. E.
   - Hill, G. W.
   - Holden, E. S.
   - Langley, S. P.
   - Moore, E. H.
   - Newcomb, S.
   - Peirce, C. S.
   - Pickering, E. C.
   - Woodward, R. S.
   - Young, C. A.
2. Physics and Engineering.
   - Abbe, C.
   - Abbott, H. L.
   - Barker, G. F.
   - Barus, C.

2. Physics and Engineering—Continued.
   - Bell, A. G.
   - Comstock, C. B.
   - Hastings, C. S.
   - Langley, S. P.
   - Mendenhall, T. C.
   - Michelson, A. A.
   - Morley, E. W.
   - Nichols, E. L.
   - Pickering, E. C.
   - Sellers, W.
   - Trowbridge, J.
   - Webster, A. G.
   - Woodward, R. S.
   - Wright, A. W.
3. Chemistry.
   - Barker, G. F.
   - Brush, G. J.
   - Chandler, C. F.
   - Chittenden, R. H.
   - Crafts, J. M.
   - Dana, E. S.
   - Gibbs, W.
   - Gooch, F. A.

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COMMITTEES OF THE ACADEMY—Continued.

On nominations of new members—Continued.

3. Chemistry—Continued.
   - Hilgard, E. W.
   - Jackson, C. L.
   - Johnson, S. W.
   - Michael, A.
   - Morley, E. W.
   - Penfield, S. L.
   - Remsen, I.
   - Richards, T. W.
   - Smith, E. F.
   - Wells, H. L.
4. Geology and Paleontology.
   - Agassiz, A.
   - Becker, G. F.
   - Beecher, C. E.
   - Chamberlin, T. C.
   - Dall, W. H.
   - Dutton, C. E.
   - Emmons, S. F.
   - Gilbert, G. K.
   - Hague, Arnold.
   - Osborn, H. F.
   - Packard, A. S.
   - Penfield, S. L.
   - Pumpelly, R.
   - Van Hise, C. R.
   - Walcott, C. D.
   - White, C. A.
5. Biology.
   - Agassiz, A.
   - Allen, J. A.
   - Bowditch, H. P.
   - Brewer, W. H.
   - Brooks, W. K.
   - Chittenden, R. H.

5. Biology—Continued.
   - Dall, W. H.
   - Farlow, W. G.
   - Gill, T. N.
   - Goodale, G. L.
   - Mark, E. L.
   - Merriam, C. H.
   - Minot, C. S.
   - Morse, E. S.
   - Osborn, H. F.
   - Packard, A. S.
   - Prudden, T. M.
   - Putnam, F. W.
   - Sargent, C. S.
   - Scudder, S. H.
   - Smith, S. I.
   - Trelease, W.
   - Verrill, A. E.
   - Walcott, C. D.
   - Welch, W. H.
   - White, C. A.
   - Whitman, C. O.
   - Wilson, E. B.
   - Wood, H. C.
6. Anthropology.
   - Billings, J. S. ✓
   - Boas, F.
   - Cattell, J. McK.
   - James, Wm. ✓
   - Minot, C. S.
   - Mitchell, S. W. ✓
   - Morse, E. S. ✓
   - Peirce, C. S. ✓
   - Putnam, F. W.
   - Welch, W. H. ✓

On Weights, Measures, and Coinage.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Newcomb, S.
Peirce, C. S.
Sellers, Wm.
Comstock, C. B.
Young, C. A.

On the Election of Foreign Associates.

Remsen, Ira, *Chairman.*
Brush, G. J.
Mitchell, S. W.
Newcomb, S.

On Publication.

The President.
The Home Secretary.
C. D. Walcott.

TRUST FUNDS.

Board of Direction of the Bache Fund.

[1879, residual estate, $47,500.]

Chandler, S. C., *Chairman.*
Bowditch, H. P.
Remsen, Ira.

Board of Trustees of the Watson Fund.

[1893, residual estate, $18,666.88.]

Newcomb, S., *Chairman.*
Elkin, W. L.
Boss, L.

The Henry Draper Fund.

[1885, $6,000.]

Pickering, E. C., *Chairman.*
Newcomb, S.
Trowbridge, J.
Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

[1885, $8,000.]

Brush, G. J., *Chairman.*
Morley, E. W.
Johnson, S. W.
Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

[1897, $20,000.]

Hall, Asaph, *Chairman.*
Chandler, S. C.
Boss, Lewis.

The Barnard Medal.

Billings, J. S., *Chairman.*
Bowditch, H. P.
Chandler, S. C.
Jackson, C. L.
Newcomb, S.
Sellers, Wm.

The Wolcott Gibbs Fund.

[1893, $2,673.17.]

Jackson, C. L., *Chairman.*
Remsen, Ira.
Drown, T. M.

The Joseph Henry Fund.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others, as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, JANUARY 2, 1904.

		Date of election.
ABBE, CLEVELAND	*2017 I st. NW., Washington, D. C.*	1879
ABBOT, HENRY L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
AGASSIZ, ALEXANDER	*Cambridge, Mass.*	1866
ALLEN, J. ASAPH	*American Museum, New York City.*	1876
BARKER, GEORGE F	*3909 Locust st., Philadelphia, Pa.*	1876
BARUS, CARL	*Brown University, Providence, R. I.*	1892
BECKER, GEORGE F	*U. S. Geological Survey, Washington, D. C.*	1901
BEECHER, CHARLES E	*Yale University Museum, New Haven, Conn.*	1899
BELL, A. GRAHAM	*1331 Connecticut ave., Washington, D. C.*	1883
BILLINGS, JOHN S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
BOAS, FRANZ	*123 W. Eighty-second st., New York City.*	1900
BOSS, LEWIS	*Dudley Observatory, Albany, N. Y.*	1889
BOWDITCH, HENRY P	*Harvard Medical School, Boston, Mass.*	1887
BREWER, WILLIAM H	*418 Orange st., New Haven, Conn.*	1880
BROOKS, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
BRUSH, GEORGE J	*14 Trumbull st., New Haven, Conn.*	1868
CAMPBELL, WILLIAM W	*Lick Observatory, Mt. Hamilton, California.*	1902
CATTELL, JAMES McK	*Garrison, N. Y.*	1901
CHAMBERLIN, THOMAS C	*University of Chicago, Chicago, Ill.*	1903
CHANDLER, CHARLES F	*Columbia University, New York City.*	1874
CHANDLER, SETH C	*16 Craigie st., Cambridge, Mass.*	1888
CHITTENDEN, RUSSELL H	*New Haven, Conn.*	1890
COMSTOCK, CYRUS B., U. S. A	*124 E. Twenty-seventh st., New York City.*	1884
COMSTOCK, GEORGE C	*Washburn Observatory, Madison, Wis.*	1899
CRAFTS, JAMES M	*88 Marlborough st., Boston, Mass.*	1872
DALL, WILLIAM H	*Smithsonian Institution, Washington, D. C.*	1897
DANA, EDWARD S	*Yale University, New Haven, Conn.*	1884
DAVIDSON, GEORGE	*2221 Washington st., San Francisco, Cal.*	1874
DUTTON, CLARENCE E., U. S. A	*Englewood, N. J.*	1884
ELKIN, WILLIAM L	*Yale University Observatory, New Haven, Conn.*	1895
EMMONS, SAMUEL F	*U. S. Geological Survey, Washington, D. C.*	1892
FARLOW, W. G	*Harvard University, Cambridge, Mass.*	1879
GIBBS, WOLCOTT	*Newport, R. I.*	——
GILBERT, GROVE K	*U. S. Geological Survey, Washington, D. C.*	1883
GILL, THEODORE N	*Smithsonian Institution, Washington, D. C.*	1873
GOOCH, FRANK A	*Yale University, New Haven, Conn.*	1897
GOODALE, GEORGE L	*Harvard University, Cambridge, Mass.*	1890
HAGUE, ARNOLD	*U. S. Geological Survey, Washington, D. C.*	1885
HALE, GEORGE E	*Yerkes Observatory, Williams Bay, Wis.*	1902
HALL, ASAPH	*Norfolk, Conn.*	1875
HASTINGS, CHARLES S	*Yale University, New Haven, Conn.*	1889
HILGARD, EUGENE W	*University of California, Berkeley, Cal.*	1872
HILL, GEORGE W	*West Nyack, N. Y.*	1874
HOLDEN, EDWARD S	*U. S. Military Academy, West Point, N. Y.*	1885
JACKSON, CHARLES L	*6 Boylston Hall, Cambridge, Mass.*	1883
JAMES, WILLIAM	*95 Irving st., Cambridge, Mass.*	1903
JOHNSON, SAMUEL W	*54 Trumbull st., New Haven, Conn.*	1866
LANGLEY, SAMUEL P	*Smithsonian Institution, Washington, D. C.*	1876
MARK, EDWARD L	*109 Irving st., Cambridge, Mass.*	1903
MENDENHALL, THOMAS C	*Worcester, Mass.*	1887

		Date of election.
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H	*University of Chicago, Chicago, Ill.*	1901
Morley, Edward W	*2238 Euclid ave., Cleveland, Ohio.*	1897
Morse, Edward S	*P. O. Box 268, Salem, Mass.*	1876
Newcomb, Simon, U. S. N	*1620 P st. NW., Washington, D. C.*	1869
Nichols, Edward L	*Cornell University, Ithaca, N. Y.*	1901
Osborn, H. F	*American Museum of Natural History, New York City.*	1900
Packard, A. S	*275 Angell st., Providence, R. I.*	1872
Peirce, Charles S	*Milford, Pa.*	1876
Penfield, S. L	*Yale University, New Haven, Conn.*	1900
Pickering, Edward C	*Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Putnam, Frederick W	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W	*Harvard University, Cambridge, Mass.*	1899
Sargent, Charles S	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scudder, Samuel H	*Cambridge, Mass.*	1877
Sellers, William	*1819 Vine st., Philadelphia, Pa.*	1873
Smith, Edgar F	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Sidney I	*Yale University, New Haven, Conn.*	1884
Trelease, Wm	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D	*U. S. Geological Survey, Washington, D. C.*	1896
Webster, Arthur G	*Clark University, Worcester, Mass.*	1903
Welch, William H	*935 St. Paul st., Baltimore, Md.*	1895
Wells, Horace L	*Yale University, New Haven, Conn.*	1903
White, Charles A	*330 T st. NW., Washington, D. C.*	1889
Whitman, Charles O	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B	*Columbia University, New York City.*	1899
Wood, Horatio C	*1925 Chestnut st., Philadelphia, Pa.*	1879
Woodward, Robert S	*Columbia University, New York City.*	1896
Wright, Arthur W	*Yale University, New Haven, Conn.*	1881
Young, Charles A	*Princeton University, Princeton, N. J.*	1872

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Louis *	....	Dec. 14, 1873
Alexander, J. H.*	....	Mar. 2, 1867
Alexander, Stephen *	....	June 25, 1883
Bache, Alexander Dallas *	....	Feb. 11, 1867
Baird, Spencer F.*	1861	Aug. 19, 1887
Barnard, F. A. P	....	Apr. 27, 1889
Barnard, J. G.*	....	May 14, 1882

* Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death.
Bartlett, W. H. C.		Feb. 11, 1893
Brown-Sequard, Charles E.*	1868	Apr. 2, 1894
Casey, Thomas L.*	1890	Mar. 25, 1896
Caswell, Alexis*		Jan. 8, 1887
Chauvenet, William*		Dec. 13, 1870
Clarke, Henry James*	1872	July 1, 1873
Coffin, James H.*	1869	Jan. 6, 1873
Coffin, J. H. C.*		Jan. 8, 1890
Cook, George H.*	1887	Sept. 22, 1889
Cooke, Josiah P.*	1872	Sept. 3, 1894
Cope, Edward D.*	1872	Apr. 12, 1897
Coues, Elliott	1877	Dec. 25, 1899
Dalton, J. C.*	1864	Feb. 2, 1889
Dana, James D.		Apr. 14, 1895
Davis, Charles H.*		Feb. 14, 1877
Draper, Henry*	1877	Nov. 20, 1882
Draper, John W.*	1877	Jan. 4, 1882
Eads, James B.*	1872	Mar. 8, 1887
Engelman, George*		Feb. 4, 1884
Ferrel, William*	1868	Sept. 18, 1891
Frazer, John Fries*		Oct. 12, 1872
Gabb, William M.*	1876	May 30, 1878
Genth, F. A.*	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gilliss, James Melville*		Feb. 9, 1865
Goode, G. Brown*	1888	Sept. 6, 1896
Gould, Augustus A.*		Sept. 15, 1866
Gould, Benjamin A.		Nov. 27, 1896
Gray, Asa*		Jan. 30, 1888
Guyot, Arnold*		Feb. 8, 1884
Hadley, James*	1872	Aug. 1, 1864
Haldeman, S. S.*	1876	Sept. 20, 1880
Hall, James		Aug. 8, 1898
Hayden, F. V.*	1873	Dec. 22, 1887
Henry, Joseph*		May 13, 1878
Hilgard, Julius E.*		May 8, 1891
Hill, Henry B	1883	Apr. 6, 1903
Hitchcock, Edward*		Feb 27, 1864
Holbrook, J. E.*	1868	Sept. 8, 1871
Hubbard, J. S.*		Aug. 16, 1863
Humphreys, A. A.*		Nov. 28, 1883
Hunt, T. Sterry	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Keeler, J. E	1900	Aug. 12, 1900
King, Clarence*	1876	Dec. 24, 1901
Kirkland, Jared P.*	1865	Dec. 10, 1877
Lane, J. Homer*	1872	May 3, 1880
Le Conte, John*	1878	Apr. 29, 1891
Le Conte, John L.*		Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carey*	1892	Mar. 15, 1897
Leidy, Joseph		Apr. 30, 1891
Lesley, J. Peter		June 3, 1903
Lesquereux, Leo*	1864	Oct. 25, 1889

* Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death.
Longstreth, Miers F	....	Dec. 27, 1891
Loomis, Elias*	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore*	1872	Sept. 10, 1897
Mahan, D. H.*	....	Sept. 16, 1871
Marsh, G. P.*	1866	July 23, 1882
Marsh, O. C	1874	Mar. 18, 1899
Mayer, Alfred M	1872	July 13, 1897
Mayo-Smith, Richmond	1890	Nov. 11, 1901
Meek, F. B.*	1869	Dec. 21, 1877
Meigs, M. C.*	1865	Jan. 2, 1892
Mitchell, Henry	1885	Dec. 1, 1902
Morgan, Lewis H.*	1875	Dec. 14, 1881
Morton, Henry	1874	May 9, 1902
Newberry, J. S.*	....	Dec. 7, 1892
Newton, H. A.*	....	Aug. 1, 1896
Newton, John*	1876	May 1, 1895
Norton, William A.*	1873	Sept. 21, 1883
Oliver, James E.*	1872	Mar. 27, 1895
Peters, C. H. F	1876	July 18, 1890
Pourtales, L. F.*	1873	July 19, 1880
Powell, John W	1880	Sept. 23, 1902
Rodgers, John	....	May 5, 1882
Rogers, Fairman	....	Aug. 23, 1900
Rogers, Robert E	....	Sept. 7, 1884
Rogers, Wm. A.*	1885	Mar. 1, 1898
Rogers, William B.*	....	May 30, 1882
Rood, Ogden N	1885	Nov. 12, 1902
Rowland, Henry A.*	1881	Apr. 16, 1901
Rutherfurd, Lewis M.*	....	May 30, 1892
Saxton, Joseph*	....	Oct. 26, 1873
Schott, Charles A	1872	July 31, 1901
Silliman, Benj., Sr.*	....	Nov. 24, 1864
Silliman, Benj., Jr	....	Jan 14, 1885
Smith, J. Lawrence*	1872	Oct 12, 1883
Stimpson, William*	1868	May 26, 1873
Strong, Theodore*	....	Feb. 1, 1869
Sullivant, W. S.*	1882	Apr. 30, 1873
Torrey, John*	....	Mar. 10, 1873
Totten, J. G.*	....	Apr. 22, 1864
Trowbridge, William P.*	1872	Aug. 12, 1892
Trumbull, James H	1872	Aug. 5, 1897
Tuckerman, Edward*	1868	Mar. 15, 1886
Walker, Francis A.*	1878	Jan. 5, 1897
Warren, G. K.*	1876	Aug. 8, 1882
Watson, James C.*	1868	Nov. 23, 1880
Watson, Sereno*	1889	Mar. 9, 1892
Winlock, Joseph*	....	June 11, 1875
Woodward, J. J.*	1873	Aug. 17, 1884
Worthen, A. H.*	1872	May 6, 1888
Wyman, Jeffries*	....	Sept. 4, 1874

*Biographical notices have been presented of those designated by an asterisk.

FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Backlund, Oskar	*Pulkowa.*
Baeyer, Adolph Ritter von	*Munich.*
Berthelot, M. P. E.	*Paris.*
Bornet, Edouard	*Paris.*
Brögger, W. C	*Christiania.*
Geikie, Sir Archibald	*London.*
Gill, David	*Cape Town.*
Hoff, J. H. van't	*Berlin.*
Hooker, Sir J. D	*London.*
Janssen, J	*Paris.*
Kelvin, Lord	*London.*
Klein, Felix	*Göttingen.*
Koch, Robert	*Berlin.*
Kohlrausch, Friedrich	*Berlin.*
Kölliker, Albert von	*Würzburg.*
Kronecker, Hugo	*Bern.*
Lankester, E. Ray	*London.*
Lister, Lord	*London.*
Loewy, Maurice	*Paris.*
Marey, E. J	*Paris.*
Mendeleeff, D. I	*St. Petersburg.*
Moissan, Henri	*Paris.*
Pfeffer, Wilhelm	*Leipzig.*
Poincaré, Henri	*Paris.*
Rayleigh, Lord	*London.*
Ricard, Émile	*Paris.*
Richthofen, F. von	*Berlin.*
Strasburger, Edouard	*Bonn.*
Struve, Otto von	*Karlsruhe.*
Suess, Edouard	*Vienna.*
Thomson, Joseph John	*Cambridge.*
Vogel, H. C	*Berlin.*
Zirkel, Ferdinand	*Leipzig.*
Zittel, Karl Alfred Ritter von	*Munich.*

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.
C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.

DECEASED FOREIGN ASSOCIATES—Continued.

Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekule.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.
Henri de Lacaze-Duthiers.
Alfred Cornu.
Rudolph von Virchow.
Sir George G. Stokes.
Karl Gegenbaur.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCE

FOR

THE YEAR 1904.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1905

REPORT

OF THE

ATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1904.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1905.

LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE PAST YEAR, 1904.

National Academy of Sciences,
Office of the President,
Washington, D. C., February 20, 1905.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

Alexander Agassiz.

The President of the Senate.

ACT OF INCORPORATION AND AMENDMENTS.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherfurd, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted,* That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882.*

True copies.

SEVELLON A. BROWN,
Chief Clerk.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN,
Chief Clerk.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1904 the Academy held three sessions. The first was the regular annual session held at Washington April 19 to 21, inclusive; the second, a scientific session held at New York November 15 and 16; the third, a special session held at New York November 16 for the tranaction of business.

ANNUAL MEETING.

The session was held at the U. S. National Museum, Washington, with the president, Mr. Alexander Agassiz, in the chair.

The following members were present during the session: Messrs. Abbot, Agassiz, Allen, Barker, Becker, Bell, Billings, Boss, Bowditch, Brooks, Brush, Chandler (C. F.), Chittenden, Crafts, Dall, Dutton, Emmons, Farlow, Gilbert, Gill, Hague, Hale, Langley, Merriam, Mitchell, Morse, Newcomb, Nichols, Osborn, Peirce, Remsen, Trowbridge, Walcott, Webster, Welch, Wells, White, Wood, and Woodward.

REPORT OF THE HOME SECRETARY.

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES:

I have the honor tó present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 18, 1904.

The annual report of the president of the Academy for 1903 was transmitted to Congress January 2, 1904, through Senator Wetmore, of Rhode Island, chairman of the Committee on the Library. The usual edition of 500 copies was received from the Public Printer February 18. Abont 200 copies of the report have been distribnted, including those sent to members of the Academy, our foreign associates, and the libraries on the exchange list.

Biographical memoirs of Augustus A. Gould, by Jeffreys Wyman and W. H. Dall; Henry A. Rowland, by Thomas C. Mendenhall; Theodore Lyman, by H. P. Bowditch; Matthew Carey Lea, by George F.

Barker; Francis A. Walker, by John S. Billings; John Gross Barnard, by Henry L. Abbot; and James Edward Keeler, by Charles S. Hastings, have been printed during the past year. It requires only two or three more memoirs to complete the volume, and it is hoped that the fifth volume of such biographical memoirs will be issued during the coming year.

At the time of the last annual meeting there were 87 names on the active membership list of the Academy. Five new members were elected at that meeting. During the year three of our colleagues have been removed by death: Charles E. Beecher, Josiah W. Gibbs, and J. Peter Lesley. The present membership list is 89. One of our foreign associates, Karl Alfred Ritter von Zittel, also died during the year. There are at present 34 foreign associates.

Very respectfully,

ARNOLD HAGUE, *Home Secretary.*

APRIL 18, 1904.

REPORT OF THE TREASURER.

WASHINGTON, D. C., *April 19, 1904.*

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 19, 1904:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	Smith fund.	Gould fund.	Emmons and Gill, trustees.	Building fund.
Balance brought forward:								
Cash	$1,511.60	$2,331.69	$1,585.61	$1,172.67	$579.13	$1,024.26	$602.11	$66.95
Invested income	2,500.00	1,000.00	2,993.71		1,496.57	1,000.00		1,500.00
Interest	270.77	2,058.85	1,100.43	368.20	353.20	881.00	50.00	67.50
Members' tax	450.00							
Appropriation returned		465.85						
Total	4,732.37	5,856.39	5,679.75	1,540.87	2,428.90	2,905.26	652.11	1,634.45
Disbursed	941.78	3,030.33	983.00	418.71	214.83	1,248.31	176.46	1.33
Transferred to capital fund				1,000.00				
Balance:								
Cash	290.59	[a]826.06	1,703.04	122.16	[b]717.50	[c]656.95	475.65	133.12
Invested income	3,500.00	2,000.00	2,993.71		1,496.57	1,000.00		1,500.00
Total	4,732.37	5,856.39	5,679.75	1,540.87	2,428.90	2,905.26	652.11	1,634.45

Outstanding obligations: [a]$125. [b]$300. [c]$250.

Very respectfully,

S. F. EMMONS, *Treasurer.*

The treasurer's report was referred to an auditing committee consisting of Messrs. Gill and Dall, who after due examination reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certifies that it has examined the statements of expenditures, receipts, and balances, and finds them to correspond to the vouchers and accounts of the treasurer.

THEO. N. GILL.
WM. H. DALL.

REPORT OF TRUST FUNDS.

REPORT OF THE BOARD OF DIRECTORS OF THE BACHE FUND FOR THE ACADEMY YEAR 1903-4.

The board of directors of the Bache fund herewith present, as a matter of courtesy to the Academy, the following statement:

Before giving an account of their operations since the last stated meeting, it may be of interest to present a summary covering a series of years past in a form which will give a perspicuous idea of the general nature of the operation of the fund and the manner in which its income has been bestowed.

Abstract of operations from January 1, 1897, to date of last report, April, 1903.

Cash balance, January 1, 1897	$3,297.31	
Deduct outstanding obligations, consisting of grants made, but not yet paid	1,252.00	
Difference, or actually available balance		$2,045.31
Add net income received from January 1, 1897, to April, 1903		13,396.53
		15,441.84
Appropriations granted during same period for—		
Geological and biological researches	$7,200.00	
Physical and chemical researches	4,800.00	
Astronomical researches	4,050.00	
Total	16,050.00	
Deduct various unused amounts returned to the fund	1,939.85	
Net cost to the fund of these researches		14,110.15
Difference between this amount and the above total of cash		1,331.69

which is the available balance April, 1903. This amount is smaller by $1,000 than the cash balance shown by the treasurer's account of the same date in the Academy report for 1903. The difference is represented by the outstanding obligation for the Chittenden grant of $1,000, made April 2, 1903, and included in the board's statement of last year, and since paid.

In this connection it may be well to note that the cash balances shown by the treasurer's reports do not, and can not in general, represent or be interpreted as balances available for appropriations, without taking into account appropriations actually made, but for which warrants have not yet come to the treasurer's hands, or those whose payment has been deferred for the convenience of the applicants or of the board. Nor can they take account of unfinished business pertaining to contemplated appropriations. In the above case, for example, while the treasurer's books showed an apparently unused balance of $2,331.69, or a little over a year's income, this was subject to a lien of $1,000 actually appropriated, as well as for pending grants of $1,450 for which warrants were to be drawn within a month, so that there was in fact an over appropriation for which the directors had to provide by splitting their drafts into deferred partial payments, in order not to overdraw their account or to leave a convenient working balance.

It will be observed by the above account of income and outgo that during the period in question the board awarded grants in excess of its receipts by the sum of $2,653.47, and that the excess of net expenditure over income was $713.62. This is gratifying, as showing a healthy activity in the operation of the endowment.

Since the period covered by the above statement—i. e., since April, 1903—the board has made the following additional appropriations.

Appropriations for the Academy year 1903–4.

1903.		
May 11.	To Charles L. Doolittle, for investigations of variations of latitude, aberration and allied problems, with reflex zenith tube and zenith telescope	$1,000
May 18.	To H. C. Wood, for a study of physiological effects of *Apocynum cannabinum*	250
May 20.	To Harry W. Morse, for investigation of luminescence of crystals	200
June 8.	To W. K. Brooks, for investigation of Salpa and other Pelagic tunicates	500
June 30.	To Theodore Lyman, for measurement of wave lengths in ultra violet region	200
1904.		
Jan. 21.	To A. S. Packard, to complete drawings for Part II of Monograph on Bombycine Moths	200
Feb. 28.	To Wallace C. Sabine, for investigation of the propagation of luminescence in the electric spark	250
Mar. 14.	To Theodore Lyman, for measurement of the Schumann short wave lengths, and investigation of their absorption in air (second appropriation)	150
Mar. 17.	To W. T. Porter, for investigation of stimulation of muscle by high-frequency electric currents	300
	Total appropriations for the Academy year 1903–4	3,050

The board has received from R. H. Chittenden the sum of $465.85, being an unused balance of appropriation made him March 30, 1897.

Including the above appropriations, the total amount of grants in aid of scientific research since the institution of the Bache fund, in 1871, is $74,793.97; deducting the unused balances returned of $4,347.68, the net amount expended is $70,446.29.

The distribution according to the various branches of science is shown in the following table:

Object.	Number.	Granted.	Returned.	Net cost.
Biology	32	$15,850.00	$2,073.02	$13,776.98
Geology and geophysics	23	12,260.00	....	12,260.00
Physics and chemistry	38	20,333.97	914.66	19,419.31
Astrophysics	17	12,675.00	....	12,675.00
Astronomy	24	13,675.00	1,360.00	12,315.00
Total	134	74,793.97	4,347.68	70,446.29

Respectfully submitted.

S. C. CHANDLER.
H. P. BOWDITCH.
IRA REMSEN.

APRIL 13, 1904.

REPORT OF THE DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND FOR THE ACADEMY YEAR 1903–4.

The directors of the Benjamin Apthorp Gould fund present the following report.

The following appropriations have been made since the last stated meeting of the Academy, April, 1903:

1903.		
May 13.	To Charles L. Doolittle, for investigation, with reflex zenith-tube and zenith-telescope, of variation of latitudes, aberration and allied problems	$1,000.00
June 15.	To Paul S. Yendell, to close the account of appropriation of December 5, 1900 ($225), of which he has refunded $63.45, January 21, 1902, making the actual sum expended for this account, net, $173.85	12.30
1904.		
Mar. 18.	To H. A. Peck, for definitive computation of cometary orbit	100.00

Following is a summary of the operation of the fund since its foundation in November, 1897:

Receipts of net income from November, 1897, to April, 1903		$4,440.81
Add estimated accrued income for year 1903–4, say		900.00
		5,340.81
Total expended for scientific investigation, as shown by the several reports of the directors to date, including outstanding obligations	$4,378.85	
Income invested as a sinking fund, toward meeting an additional, deferred, and contingent grant of $2,500, reported on page 11 of the Academy's report of 1902	1,000.00	
		5,378.85
Excess of appropriations made over income, to date		38.04

Respectfully submitted.

ASAPH HALL.
LEWIS BOSS.
SETH C. CHANDLER.

REPORT OF THE WATSON TRUSTEES.

Under the arrangement already reported to the Academy, the work of preparing tables of the Watson asteroids has been carried on under direction of Prof. A. O. Leuschner, of the University of California. The latter has two computers working under his direction, and he reports a satisfactory rate of progress. The general perturbations of all the asteroids discovered by James C. Watson are substantially completed, with the exception of Aethra, which was observed only during the opposition at which it was discovered, and has never been recognized since. To all appearance this asteroid will have to be left out of the present consideration.

There is still an available balance of income of $1,295.04, which, with the accruing income, will enable the work to be carried on through at least the present year. The principal work which now remains to be done is to tabulate the perturbations, compare the results with observations, and correct the elements.

Respectfully submitted.

Simon Newcomb,
Chairman Watson Trustees.

REPORT OF THE HENRY DRAPER COMMITTEE, 1903–4.

The fifth clause of the deed of gift by Mrs. Henry Draper, establishing the Henry Draper fund, is as follows:

> Fifth. In trust, that if at any time or times the interest and income of the said trust fund of $6,000 shall exceed the amount necessary for the striking of said medal and the care of the said die and of the fund, such surplus over and above the sum or sums so required for the purposes of the trust as hereinbefore recited and set forth shall be used in such manner as shall be selected by said National Academy of Sciences, in aid of investigation and work in astronomical physics to be made and carried on by a citizen or citizens of the United States of America.

In a letter dated June 22, 1903, Mrs. Draper writes:

> With reference to the Henry Draper medal fund of the National Academy of Sciences, my desire is that the income thereof, above what is required to provide the Draper medals, should be allowed to accumulate and should be added to the principal until the latter amounts to $10,000. Thereafter any excess of income of this fund over and above that needed for the purchase of medals I should be willing to have used, under the direction of the Academy, for purposes of research in the line for which the fund was originally given.

It is therefore recommended by the committee that no appropriations be made for research, but that the excess of income be added to the principal.

Edward C. Pickering, *Chairman.*

The Academy, on recommendation of the council, adopted the following resolution:

Resolved, That the treasurer be instructed to reserve the income of the Draper fund not required for the giving of the Draper medal and invest it until the original fund amounts to ten thousand dollars; provided that in a case of exceptional importance, the trustees of the Draper fund be instructed to bring the application for a grant before the Academy.

ELECTIONS.

Messrs. Billings, Bowditch, Brush, Hale, Walcott, and Welch, were elected members of the council.

Messrs. William T. Councilman, William Morris Davis, John Ulric Nef, and William Fogg Osgood, were elected members of the Academy.

The following-named gentlemen were elected foreign associates of the Academy: Messrs. Ludwig Boltzmann, of Vienna; George H. Darwin, of Cambridge; Paul Ehrlich, of Frankfurt-am-Main; Emil Fischer, of Berlin; William Huggins and William Ramsay, of London; H. Rosenbusch, of Heidelberg, and Hugo de Vries of Amsterdam.

DEATHS.

The Academy lost only one member during the year 1904, Mr. Charles Emerson Beecher, who died on the 14th of February.

Karl Alfred Ritter von Zittel, a foreign associate, died January 5, 1904.

INTERNATIONAL ASSOCIATION OF ACADEMIES.

The International Association of Academies, of which the National Academy of Sciences is a constituent member, met in London May 25–27, 1904. Our Academy was represented by one of its foreign members, Sir Archibald Geikie, F. R. S. The object of this association is to promote cooperation among the leading scientific organizations of the world and to suggest and support lines of research in subjects of international importance.

Among the subjects to which attention was especially directed at the meeting was the proposed work of the International Seismological Association, in which it is hoped that the United States will be represented.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

On Fluorescence Spectra. E. L. Nichols and Ernest Merritt.

Spectra of Gas at High Temperatures. John Trowbridge.

Short Wave-Lengths of Light. Theodore Lyman. (Presented by John Trowbridge.)

Spectra produced by the Wehnelt Interrupter. H. W. Morse. (Presented by John Trowbridge.)

Note on Radioactivity and Autoluminescence. George F. Barker.

A Double Suspension Apparatus for determining the Acceleration of Gravity. R. S. Woodward.

The Compressibility of the Earth's Mass required by the Laplacian Law of Density Distribution. R. S. Woodward.

The Disposition of Rainfall in the Basin of the Chagres. Henry L. Abbot.

Surface Friction of the Air at Speeds below 40 Feet a Second. A. F. Zahm. (Introduced by A. Graham Bell.)

Physiological Economy in Nutrition, with Special Reference to the Minimal Proteid Requirement of the Healthy Man. A Preliminary Report. R. H. Chittenden.

Recent Palæontological Discoveries by the American Museum Exploring Parties. Henry F. Osborn.

Reclassification of the Reptilia. Henry F. Osborn.

Position of the Limbs in the Sauropoda. W. D. Matthew. (Submitted by Henry F. Osborn.)

A Preliminary Report upon Apocynum cannabinum. Horatio C. Wood, jr. (Presented by Horatio C. Wood.)

Biographical Memoir of James Hadley. Arthur T. Hadley. (Presented by the Home Secretary.)

Biographical Memoir of Henry Barker Hill. Charles L. Jackson.

The Multi-nippled Sheep of Beinn Bhreagh. Alexander Graham Bell.

Application of New Statistical Methods to the Question of the Causes Influencing Sex. Simon Newcomb.

Note on the Simplest Possible Branch of Mathematics. C. S. Peirce.

The president announced the appointment of Messrs. Gilbert and Hale to represent the Academy at the fiftieth anniversary of the founding of the University of Wisconsin.

The president announced that Sir Archibald Geikie and E. Ray Lankester, foreign associates of the Academy, had been appointed to represent the Academy at the meeting of the International Association of Academies May 24, 1904; also that the Royal Academy of Sciences of Madrid had been admitted to membership in the International Association of Academies.

PRESENTATION OF THE DRAPER MEDAL.

The Henry Draper medal was presented to Mr. George E. Hale at the New Willard Hotel, Washington, on Wednesday evening, April 20, 1904. Upon this occasion the following statement was read giving the reasons for this award:

To the National Academy of Sciences:

The work of Professor Hale may be divided into four classes: Investigations of solar phenomena, studies of stellar spectra, editing the Astrophysical Journal, and the executive work involved in the direction of the Yerkes Observatory. In 1868, it was shown by Janssen and Lockyer, independently, that solar protuberances might be observed when the sun was not eclipsed. The method employed was to allow an image of the edge of the sun's disk to fall upon the slit of a spectroscope, and thus obtain the spectrum of this region only. If the image of a protuberance fell upon the slit, so large a portion of its light was monochromatic that the hydrogen line C appeared as a bright line in the corresponding portion of the spectrum. If now the slit was widened, the form of the protuberance became visible. By placing a second slit so as to cut off all portions of the spectrum except that of the line to be studied, replacing the eyepiece by a photographic plate, and giving similar motions to the latter and to the image of the sun on the slit we have the spectroheliograph. The principal credit must be given to Professor Hale for the independent invention of this instrument, for excellence in the plans of its mechanical construction, for skill in its use, and for the final results obtained with it, although as almost always happens, a portion of the credit must be given to other astronomers who were pursuing the same line of work. With this instrument we may therefore analyze the light of any object, obtaining a series of photographs which show the relative proportion of rays of each different wave length in its different parts. When the sun is the object observed we obtain widely different results for the protuberances, faculæ, and spots. The extent and character of the different portions is thus shown far better than would be possible in an ordinary photograph.

Professor Hale has shown the same skill in invention, construction, and application in the other portions of his work. The problem of photographing the spectra of stars of the third and fourth types is one of unusual difficulty. Owing to the red color of these stars they ordinarily produce but little impression upon the photographic plate. By the great light-collecting power of the 40-inch refractor, and the use of isochromatic plates, Professor Hale succeeded in photographing the spectra of these stars with a large dispersion. He was thus able to classify them and to show the resemblances of the spectra of stars of these two classes. This is the more remarkable since visually or with a small dispersion the spectra appear very unlike.

During the years 1893, 1894, and 1895 Professor Hale edited the astrophysical portion of Astronomy and Astrophysics. In January, 1896, he established the Astrophysical Journal, associating with him the leading astrophysicists of the world as assistant editors. With the liberal support of the University of Chicago he has made this journal a nearly complete compendium of the work done in astrophysics during the last nine years.

The manifold duties of the director of a great observatory may not be appreciated by one who sees only the results. To attain success good judgment, patience, skill, and knowledge of a great variety of subjects are required. For the establishment, erection of buildings, construction of instruments, selection of officers, general plan of work, and assignment of duties, a vast amount of time and energy is required before the actual scientific work begins. Those who avail themselves of these facilities may fail to remember that but for the director none of these appliances would have been at their disposal. It is unnecessary to enumerate the researches carried on and in progress at the Yerkes Observatory, and how much astronomy would have lost but for its liberal endowment and skillful direction.

The reasons enumerated above show why the Henry Draper medal has been awarded to Prof. George Ellery Hale.

AUTUMN MEETING OF THE ACADEMY.

SCIENTIFIC SESSION.

[Held in New York November 15 and 16, 1904.]

A scientific session for the reading of papers having been called by the council, the Academy met in Havemeyer Hall of Columbia University, New York City, November 15 and 16, 1904.

Vice-President Remsen presided at the sessions, and the following members were in attendance: Messrs. Billings, Boas, Boss, Bowditch, Brewer, Brooks, Cattell, Chandler (C. F.), Chittenden, Comstock (C. B.), Dutton, Emmons, Hague, Hastings, Mitchell, Morley, Morse, Newcomb, Peirce, Penfield, Prudden, Remsen, Verrill, Walcott, Webster, Wells, and Woodward.

The following papers were presented:

Biographical Memoir of Charles Emerson Beecher. W. H. Dall.

On the Affinities of the Pelagic Tunicates. W. K. Brooks.

The Life History of *Turritopsis*. W. K. Brooks and S. Rittenhouse.

Phoronis architecta; Its Anatomy, Life History, and Branching Habits. W. K. Brooks and R. P. Cowles.

On the Electrical Resistance of a Vacuum. John Trowbridge.

Psychic Associations in Primitive Culture. Franz Boas.

Time Electrical Impulses. M. I. Pupin. (Introduced by R. S. Woodward.)

The Occurrence of Maxima and Minima of Atmospheric Nucleation in Approximate Coincidence with the Winter and Summer Solstices, respectively. C. Barus.

The System of Magnetic Forces Causing the Secular Variation of the Earth's Magnetism. L. A. Bauer. (Introduced by R. S. Woodward.)

The Influence of Low Proteid Metabolism on the Formation and Excretion of Uric Acid in Man. Russell H. Chittenden.

Note on the Theory of Experiments to Detect the Second Power of the Aberration of Light. Edward W. Morley.

Report of a Repetition of the Michelson-Morley Experiment on the Drift of the Earth through the Luminiferous Ether. Edward W. Morley.

On Topical Geometry. C. S. Peirce.

An Experimental Demonstration of the Formation of Centrosomes de novo. N. Yatsu. (Presented by E. B. Wilson.)

An Analysis of the Phenomena of Organic Polarity. T. H. Morgan. (Introduced by E. B. Wilson.)

Experiments on Prelocalization in the Annelid Ovum. E. B. Wilson.

The Absolute Value of the Acceleration of Gravity Determined by the Ring-Pendulum Method. C. E. Mendenhall. (Presented by R. S. Woodward.)

The Double Suspension Pendulum for Measuring the Acceleration of Gravity. R. S. Woodward.

Biographical Memoir of Robert Empie Rogers. Edgar F. Smith.

A Determination of the Dispersive Power of the Human Eye. Charles S. Hastings.

The Air in the New York Subway. Charles F. Chandler.

The Genus Claytonia: Morphological and Anatomical Studies. Theo. Holm. (Introduced by George L. Goodale.)

BUSINESS MEETING.

[New York, November 16, 1904.]

A business meeting of the Academy was held November 16, with the vice-president, Mr. Ira Remsen, in the chair.

PRELIMINARY REPORT FROM THE COMMITTEE ON SOLAR RESEARCH.

The PRESIDENT AND COUNCIL OF THE NATIONAL ACADEMY OF SCIENCES.

GENTLEMEN: We have the honor to report that immediately after the appointment of the committee by the Academy, plans were made to secure the aid of various societies in Europe and America for the purpose of preparing a general scheme of cooperation in solar research. The societies were invited to appoint committees on solar research, and to send delegates to a conference, which we decided to hold in September at St. Louis, on the occasion of the International Congress of Arts and Sciences. Some societies had already adjourned for the summer when the invitations were received, and therefore could not comply with our request. Nevertheless, the general response was very satisfactory, and the meeting of delegates at St. Louis was a fairly representative one.[a]

We respectfully request the Academy to ask the approval by the International Association of Academies of the proposed plan of cooperation in solar research. It is desirable that such approval should be secured as soon as possible, in order that the work may be well organized before the sun-spot maximum, which may occur next year.

It was the wish of the conference that all of the committees representing societies should be standing committees, in order that the members may frequently discuss the various questions under consideration. We accordingly request that this committee be continued.

Respectfully submitted.

GEORGE E. HALE, *Chairman.*

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[a] The various papers read at the conference on solar research may be found in the Astrophysical Journal, Vols. XX-XXI, No. 5, December, 1904 and No. 1, January, 1905.

The following resolutions were adopted:

Resolved, That the National Academy of Sciences ask the approval by the International Association of Academies of the proposed plan of cooperation in solar research, as set forth in the report of the committee having that matter in charge.

Resolved, That the committee on solar research be made a standing committee of the Academy.

REPORT OF THE COMMITTEE ON SOLAR RESEARCH OF THE NATIONAL ACADEMY OF SCIENCES.

The committee on solar research respectfully submits the following report:

The committee was appointed at the annual meeting in April, 1904, in accordance with the following resolution:

Resolved, That a committee be appointed to consider the preparation of general plans for solar research and to cooperate with other committees and institutions in preparing plans in case such action appears to be advisable.

As soon as possible after the annual meeting, a circular letter was sent to various academies and societies in Europe and the United States, requesting them to appoint committees on solar research, and to send delegates to an international conference, at which steps would be taken to perfect a plan of organization. It was recognized that no final action, respecting which the opinions of solar physicists in general should be obtained, could be taken at this preliminary conference, the purpose of which was rather to prepare the way for definitive work at a later date.

The minutes of the conference, which was held at St. Louis on September 23, 1904, are appended to this report. The decisions of the conference have been communicated to the various academies and societies, and appointments of representatives of the various committees as members of the international committee have been made in a number of cases. The committee on programme, appointed at St. Louis, is also at work. At the recommendation of the committee the following resolution was adopted at the business meeting of the Academy held in New York November 16, 1904:

Resolved, That the National Academy of Sciences ask the approval of the International Association of Academies of the proposed plan of cooperation in solar research, as set forth in the report by the committee having that matter in charge.

This resolution and the report was referred to Prof. Simon A. Newcomb, foreign secretary, for transmission to the International Association of Academies. A resolution making the committee on solar research one of the standing committees of the Academy was also adopted.

It is expected that a second conference will be held in Europe in the autumn of 1905, and that a definite plan of cooperation in solar research will then be adopted.

The following table contains a list of committees, delegates to the St. Louis conference, and members of the international committee, hitherto appointed by various societies:

Society.	Committee.	Delegates present at conference.	Member of international committee.
Royal Society of England	Huggins, Christie, Lockyer, Schuster, Newall.	Turner	
Royal Astronomical Society	Turner, and others to be appointed.	do	
Astronomical Society of France.	Deslandres, de la Baume Pluvinel, Guillaume, Flammarion.	Poincaré	Deslandres.
French Physical Society	Poincaré, Fabry, Pérot, Deslandres.	do	
German Physical Society	Ebert, Kayser, Kreusler, Lummer, Pringsheim, Runge, Straubel, Wilsing.		Kayser.
Amsterdam Academy of Sciences	Kapteyn, Julius	Kapteyn	
Society of Italian Spectroscopists	Tacchini, Riccò, Chistoni, Mascari.		
Vienna Academy of Sciences	Hann, Weiss, von Lang, Exner.	Boltzmann	
St. Petersburg Academy of Sciences.	Bèlapolsky and others	Backlund	
Subcommittee of International Meteorological Committee.		Rotch	
Stockholm Academy of Sciences.	Hasselberg, Dunér, Ångström	Arrhenius[a]	
Astronomical and Astrophysical Society of America.	Frost, Abbot, Bauer, Jewell, Perrine.	Frost, Abbot, Bauer, Jewell, Perrine.	Abbot.
American Physical Society	Ames, Crew, Lewis, Mendenhall, E. F. Nichols.	Crew, Mendenhall.	
National Academy of Sciences	Hale, Campbell, Langley, Michelson, Young.	Hale, Campbell	Hale.

[a] Acting unofficially.

Respectfully submitted.

GEORGE E. HALE.
W. W. CAMPBELL.
S. P. LANGLEY.
A. A. MICHELSON.
C. A. YOUNG.

SUPPLEMENTARY PAPER—INTERNATIONAL COOPERATION IN SOLAR RESEARCH.

[Minutes of the meeting of delegates to the conference on solar research, held in the hall of congresses, St. Louis, September 23, 1904.]

As chairman of the committee on solar research of the National Academy of Sciences, which had issued the call for the conference, Prof. George E. Hale called the meeting to order and explained the purpose of the conference. After referring to previous movements to secure cooperation in solar research, he emphasized the importance of encouraging individual initiative, and urged that no less attention be paid to such encouragement than to the accomplishment of large pieces of routine work through cooperative effort.[a]

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[a] See Astrophysical Journal, December, 1904.

The following officers were then elected to serve for this meeting: President, Prof. George E. Hale; vice-president, Prof. Henri Poincaré; recording secretary, Prof. C. D. Perrine.

A motion that for this meeting the voting be by societies, and that each society be allowed one vote, was adopted.

A motion was made and carrried that the chairman of each society's committee should cast the vote for that society.

After some remarks by Professor Hale on cooperation, the following motion was made by Professor Turner:

That this meeting is in favor of the organization of a scheme of international cooperation in solar research which shall encourage individual initiative, provide suggestions for definite lines of work, and facilitate the collection of results for publication.

This expression, after remarks by Professors Poincaré, Boltzmann, and Hale, was made the sense of the meeting.

Professor Hale stated that in appointing its committee on solar research the National Academy of Sciences had given the committee authority to join the president and foreign secretary of the academy in presenting its plans for cooperation to the International Association of Academies. The opportunity now existed of securing the views of the conference on this subject.

After remarks by various delegates upon the relations of scientific societies among themselves and to the International Association of Academies, the following motion was made by Professor Poincaré:

That the committee to be appointed at this meeting negotiate with the Academy of Sciences of Vienna with the view of obtaining the approval and the patronage of the International Association of Academies.

This motion was seconded by Professor Boltzmann and adopted.

A short discussion then ensued upon the fullness of the representation of interested individuals and societies in the preparation of plans for cooperation in solar research.

Doctor Bauer moved that the subcommittee on terrrestrial magnetism and atmospheric electricity of the international meteorological committee be invited to appoint a committee to cooperate with the solar research committee.

This motion was seconded by Mr. Rotch and adopted.

Professor Turner moved that the Hungarian Academy of Sciences of Budapest also be invited to appoint a committee to cooperate with the solar research committee.

This motion was seconded by Professor Frost and adopted.

The following general motion was then made by Professor Poincaré and adopted:

That the international committee on solar research, to be appointed, be authorized to invite, at its discretion, societies and individuals which have been omitted, to cooperate.

The subject of the formation of an international committee was then discussed.

Professor Turner moved that each committee participating be invited to appoint a member to serve on the international committee.

This motion was seconded by Professor Campbell and adopted.

Mr. Rotch, delegate of the subcommittee of the international meteorological committee on the relationship between meteorological and solar phenomena, reported on the recent meeting of the subcommittee at Cambridge. At that meeting the invitation of the National Academy of Sciences to cooperate with the other committees was accepted.

A short discussion followed on a provisional programme of observations, at the conclusion of which Professor Turner nominated the following gentlemen as a committee to prepare a provisional programme, such committee to have power to add to its number at discretion: Prof. George E. Hale, Prof. Arthur Schuster, Prof. Svante Arrhenius.

Suggestions from M. Deslandres as to observations to be undertaken, and the adoption of certain names of instruments and solar phenomena, were, at the suggestion of Professor Poincaré, referred to the committee on programme.

Following a discussion of routine measurements and computation, Professor Turner offered, on behalf of the Oxford University Observatory, to undertake a portion of this work.

A motion was therefore made by Mr. Abbot that the international committee enter into negotiations with the Oxford University Observatory with the view of providing for the measurement of plates and the reduction of solar observations.

This motion was seconded by Professor Campbell and adopted.

The suggestion was made by Doctor Bauer that if visual magnetic observations, especially magnetic observations at the eclipse of 1905, could be made at observatories with special instruments provided for the purpose, it was practically certain that the reduction of such observations would be undertaken by the Carnegie Institution.

A memoir on standards of wave length, prepared by MM. Pérot and Fabry on behalf of the Physical Society of France, was presented by Professor Poincaré.[b]

A motion that standards of wave length should be determined from terrestrial instead of solar sources was referred for consideration to the international committee.

Professor Crew discussed the question of standards of wave length, and pointed out the necessity of replacing Rowland's standards by a new system. He also presented a paper on this subject by Professor Kayser and a letter from Professor Michelson.[a]

Mr. Jewell presented in abstract a paper on Rowland's standards.[a]

A motion by Professor Poincaré was then adopted referring these communications to the international committee.

Owing to a lack of time for discussion the subject of total solar eclipses was referred to the international committee upon motion of Professor Campbell.

Oxford and Meudon were suggested as places for the next meeting. The international committee was empowered to decide both the place and time of meeting, on motion of Professor Frost, seconded by Professor Poincaré.

Upon motion of Professor Poincaré the thanks of the conference were tendered to Professor Hale for his interest and activity in connection with the conference.

The conference then adjourned.

C. D. Perrine, *Recording Secretary.*

SCIENTIFIC SURVEYS OF THE PHILIPPINE ISLANDS.

[Report of a committee appointed in pursuance of a request from the President of the United States.]

National Academy of Sciences,
Norfolk, Conn., February 12, 1903.

Sir: I have the honor to transmit to you herewith the report of the committee appointed, at your request, to consider and report upon the desirability of instituting scientific explorations of the Philippine Islands and on the scope proper to such an undertaking.

I am, sir, very respectfully, your obedient servant,

Asaph Hall,
Vice-President National Academy of Sciences.

The President.

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[a] To be published in the December number of the Astrophysical Journal.

WHITE HOUSE,
Washington, December 26, 1902.

MY DEAR MR. AGASSIZ: I should like much a report from the National Academy of Sciences on the desirability of instituting scientific explorations of the Philippine Islands and on the scope proper to such an undertaking. The National Academy is the official scientific adviser of the Government, and I would like its cooperation in planning a comprehensive investigation of the natural resources and natural history of the islands. It will of course rest with Congress to decide the extent to which such a plan can be carried through; but I should like, at any rate, to have a plan formulated and to do what I can to have it adopted.

Sincerely yours,

THEODORE ROOSEVELT.

Prof. ALEXANDER AGASSIZ,
President of the National Academy, Cambridge, Mass.

NATIONAL ACADEMY OF SCIENCES,
Washington, D. C., January 14, 1903.

DEAR SIR: In response to a letter addressed by President Roosevelt to Mr. Agassiz, as president of the National Academy of Sciences, and in the absence of Mr. Agassiz from the country, Vice-President Hall has named the following committee to formulate a plan of organization as suggested by the President: William H. Brewer, chairman; George F. Becker, C. Hart Merriam, F. W. Putnam, R. S. Woodward.

This committee was named after consultation with the members of the council living in Baltimore and Washington.

Very respectfully, yours,

ARNOLD HAGUE, *Home Secretary.*

Mr. WILLIAM H. BREWER,
Yale University, New Haven, Conn.

REPORT OF THE COMMITTEE.

(1) NEED FOR COMPREHENSIVE WORK.

The committee has the honor to report as follows:

The primary incentive to scientific exploration of the Philippine Islands, as of any other region, is a desire to promote the commercial and industrial welfare of the inhabitants, and this purpose should never be lost sight of. Experience shows that this end is best attained by a comprehensive investigation of facts and conditions undertaken in a broadly scientific spirit. Millions of dollars have been spent in searching for coal in regions where the rocks are far older than the coal measures. It was the seemingly unpractical science of paleontology which put a stop to this waste and enabled geologists to outline the areas to which valuable coal fields are limited. So, too, antiseptic surgery is an application of recondite branches of botany and chemistry. The vast benefits which the Agricultural Department and the Fish Commission have conferred upon our country are founded upon the untiring labors of zoologists, botanists, and chemists whose sole purpose was to elucidate the truth; and long after Franklin took the first step in the science of electricity, economic applications of the knowledge acquired were almost undreamed of. In short, modern industrial development is an outgrowth of pure science, and almost every discovery of science is ultimately turned to economic account. Hence it would be short-sighted not to extend to the Philippines the broad and generous spirit of research which animates the governmental scientific work of the United States.

The main object to be sought in planning explorations of the Philippines is not to suggest new or unusual subjects of study or methods of study, but to provide against duplication of work, and to arrange for such cooperation between the officers engaged in different branches of the scientific surveys as will insure rapid, satisfactory, and economical progress in a noble contribution to human knowledge.

Since the United States is engaged in the first serious attempt to develop an Anglo-Saxon civilization in the Tropics, and among a non-Aryan people, it may not be amiss to call attention to the effect on the enlightenment and culture of the Filipinos which systematically undertaken scientific surveys must inevitably produce. Such explorations will be a practical lesson in the application and value of learning.

(2) RESOURCES OF THE ISLANDS.

The Philippine Islands form an extreme portion of one of the most interesting areas in the world, viz, Malaysia. The archipelago lies along the edge of the great and permanent abyss of the Pacific Ocean, forming the last bulwark of the Asiatic continent toward the southeast. This geographical position, half way between Japan and Australia, with the China Sea on one side and the Pacific on the other, is most favorable to the development of a great commerce, which indeed the Philippine Islands once enjoyed.

The archipelago has not always been separated from Borneo, Java, Sumatra, and the Peninsula of Malacca; on the contrary, land connections throughout this area existed at various times in its geological history. It is also probable that at one time Luzón and Formosa were connected. The islands themselves have undergone many geological vicissitudes, still indicated in part by the belts of extinct and active volcanoes which intersect them.

Gold veins, seemingly of very ancient origin, are widely distributed in the islands, though no great gold field is known to exist there; and there are some valuable copper deposits. The Philippines contain also important deposits of mineral fuel similar to the so-called coals of Japan and Borneo—a good quality of lignite—upon which much of the industrial development of the islands must depend. It is well known that the fertility of the Philippines is astonishingly great. This is due primarily to a favorable admixture of various igneous rocks with limestones and sandstones. In the moist and equable climate of the archipelago the rocks are rapidly converted into soil, while the absence of cold and drought results in a vigorous growth of roots, which protects the soil, as soon as formed, from rapid erosion by the heavy rains. One evidence of the fertility of the land is the presence of superb hardwood forests. These have been estimated to cover at least a third of the area of the islands, or, say, forty thousand square miles, and they include nearly two hundred species of valuable timber trees. All tropical crops will grow in the Philippines, while that very important plant (*Musa textilis*), which yields the so-called manila hemp, flourishes best in the archipelago. The resources of the islands have been very imperfectly developed; indeed, under Spanish rule, attempts at industrial progress usually met with disfavor. After the establishment of a well-ordered peace, the first step in progress must be the accumulation and dissemination of accurate and systematic information.

(3) NEED OF COORDINATION.

In order rapidly and economically to provide the information desired, it is essential that the various branches of the work should be coordinated, for they are to a considerable extent interdependent; for example, topographical maps, which are an indispensable preliminary to geological mapping, are also required for planning highways, for military purposes, for the Land Office, for the Bureau of Forestry, and for other ends.

It will be necessary in the Philippines, as elsewhere, to map some regions on a larger scale than others. Simple relations between the several scales used should be maintained, as is done in the topographical mapping of the United States. In selecting the scale for any region the uses to which the map is to be put should be well considered and the survey made with an amount of detail adequate to the use in view. A naval station, an army post, or the location of a possible canal should be surveyed in greater detail than would elsewhere suffice. It seems entirely practicable to forsee the probable development of a system of highways, since these are largely controlled by natural conditions, and there is no reason why the development of means of communication should not be taken into consideration in the original surveys. The mapping of each area should thus be undertaken on such a scale as will suffice for the several purposes to which the Government expects to apply the maps. Similarly, geological work should be done not merely with a view to elucidating the physical and biological history of the archipelago, or even to describing the mineral resources of the islands; the origin of soils, the occurrence of road metal, and the facilities for or the obstacles to the cutting of canals, tunnels, or roads should be systematically reported upon from a geological point of view. Indeed it is manifest that assistance can and should be rendered by each branch of a complete survey to one or more coordinate branches. For this reason a plan of cooperation will be suggested somewhat later.

(4) SCOPE OF INQUIRY.

The subjects which it is advisable for the Government to investigate in the Philippines may be grouped as follows:

Coast and geodetic work and marine hydrography.
Land topography, including surveys and classification of the public land.
Geology and mineral resources.
Botany.
Problems of forestry.
Zoology.
Anthropology.

All of these subjects may be embraced under the general term scientific explorations, and their study may be carried to a satisfactory degree of completion in a few years.

Several other lines of inquiry are omitted from the enumeration, although they also are of great importance in the economic development of the islands. They are chiefly of local interest and are largely administrative, but are permanent in character. They include meteorology, sanitation, the study of animal parasites, insect pests, and the fungus diseases of plants, as well as sylvicultural and administrative forestry, and the establishment of agricultural experiment stations and of zoological and botanical gardens. These lines of investigation have already been initiated and more or less fully provided for by the civil government of the Philippine Islands. The scientific surveys would naturally cooperate as far as possible with the insular scientific bureaus, to the great advantage of both.

These several branches of the inquiry will furnish contributions to human knowledge the importance of which will probably stand in the following order: Zoology, anthropology, botany, forestry, geology.

(5) COAST AND GEODETIC WORK.

The first step to be taken in the survey of the Philippines is the establishment of geographical stations and a primary triangulation.

The position of Manila observatory is of course well known, and many other points have doubtless been well determined, but the accuracy of existing determinations should be checked and the net-work completed. The land area of the archipelago is not large—only about 120,000 square miles—but because of its distribution in several hundred islands the area to be triangulated is far larger.

The importance of marine hydrography requires no emphasis further than to recall the accidents and disasters which have occurred in the Philippine Islands since the American occupation for lack of adequate surveys and charts. It seems eminently desirable that, as fast as the triangulation is sufficiently advanced, a survey should be made of the very extensive shore line of the archipelago by a corps of marine hydrographers. These can determine better than topographers the amount of detail desirable in the line common to land and marine surveys. The line so determined should be accepted by both corps, and from it the hydrographers should work seaward and the topographers inland. The hydrographers will meet with especial difficulties on account of the innumerable coral reefs in the Philippine waters, and may also have trouble with recent uplifts, such as are alleged to have taken place within a few years in the Island of Paragua. There and elsewhere bench marks should be established.

The Coast and Geodetic Survey has already begun work in the Philippines. It has occupied twenty-eight well-distributed astronomical stations, all in telegraphic communication with Manila, commenced a considerable number of harbor surveys, and initiated tidal observations at numerous points. It has also planned more extensive operations.

(6) TOPOGRAPHY.

Topographic work in the mountainous and wooded portions of the Philippines will be extremely difficult, the vegetation being so dense as to form an almost complete obstacle to vision and to free locomotion. However, in various portions of the archipelago, extensive open plains exist which can be rapidly mapped. It will probably be found that the native Filipinos will readily adapt themselves to topographical work, and, as they are extraordinarily agile, they will be of great assistance in the mountains and the forests. It is in the highest degree desirable that the surveys and subdivisions of the public lands should be committed to a topographical corps, such as that of the Geological Survey, as has been done, for example, in the Indian Territory. The topographical maps should show forest areas, but the discrimination of agricultural and mineral lands is not contemplated. As has been already noted, the scales employed should answer to the prospective uses to which the topographical maps are to be applied.

(7) GEOLOGY.

The geological problems to be solved are numerous. The economic question of greatest moment is the stratigraphy of the coal-bearing Eocene formation, which is most extensively developed in southeastern Luzón (Albay and Sorsogón) and the island of Cebú. It is probable, but not certain, that the coal deposits of Mindanao belong to the same period. The Eocene has been much disturbed and considerably faulted, so that its study will be a somewhat serious task. The coral reefs, volcanoes, and earthquakes will necessarily also demand the attention of geologists.

The dense vegetation of the Tropics offers great obstacles to the study of geology, and in the Philippines the lack of roads will also delay the work. There is, however, one set of exposures which are admirable and of vast extent, as well as readily accessible by proper means. It has been estimated that there are over 11,000 miles of seacoast, without counting minor indentations, and along most of this line the rocks are exposed by wave action. The study of the geology of the country will probably proceed most rapidly if begun from boats along these coasts, and in beginning geological work on any of the smaller islands it will probably be expedient as well as most economical first to circumnavigate the island in steam launches, mapping the exposures with care. With the information thus obtained it will be comparatively easy to extend the surveys into the interior.

The geological formations of the East Indies, including Malaysia, are as yet imperfectly correlated with those of Europe. The distance separating these two regions is so great, and the intervening land mass with its peculiar mountain systems is so immense, as easily to account for extreme differences in fossil remains, rendering it difficult to correlate the two systems. On the other hand, in America, where the mountains and coasts have a southerly trend, formations can be followed from the Temperate Zone into the Tropics with no great difficulty, and a definite correlation has thus been obtained. Hence it is advisable that the geologists, and especially the paleontologists, who may be sent to the Philippines should have familiarized themselves with the geology of the marine strata of the West Indies and the Gulf of Mexico. In some respects knowledge of the geology of the Tropics is of more importance in the elucidation of the earth's history than that of the Temperate Zone. Climatic conditions along the equator must always have been more equable than in the Temperate Zone, and the development of life must have been less affected by changes in local conditions. Hence near the equator, if anywhere, will be found evidence of variations in the climate of the earth as a whole in earlier geological times, variations such as may have been due to changes in solar emanation or in the composition of the earth's atmosphere.

Attention has already been called to the fact that geologists should systematically lend assistance in the study of soils and in the development of a system of highways.

(8) ZOOLOGY AND BOTANY.

The Philippines have long been an attractive field for the student of natural history, and some of the most important theories respecting the origin, distribution, and coloration of animals and plants have resulted from studies in this region. It was chiefly from observations of the insects of the archipelago that Wallace discovered the law of natural selection independently of Darwin, who had not then published his Origin of Species. But the fauna and flora are still very imperfectly known. Field work in ornithology has been more thorough than in the other lines; nevertheless, several of the larger islands have been only slightly explored, and some of the smaller ones not at all. A small collection of mammals made by a bird collector on Mount Datá, in northern Luzón, comprising only such species as were brought to him alive by the natives, contained half a dozen new generic groups. This may be taken as a promise of what will be learned when the numerous lofty mountains of the larger islands are systematically explored. Heretofore most of the natural history work has been along the coast and larger rivers. In future the most promising and important field, and also the most difficult so far as land species are concerned, is in the highlands of the interior.

The fauna of the Philippines is complex in origin and heterogeneous in character. It consists of types originally derived in part from the south (Borneo, Celebes, and the Moluccas) and in part from the north (Formosa and southeastern China); hence it is not surprising that the animals and plants of certain islands differ widely from those of other islands. It is important that the fauna and flora of each island be studied in detail, and that the zoological work include mammals, birds, reptiles, batrachians, fishes, insects, and marine invertebrates; and that the botanical work include, besides systematic botany, the study and identification of the food plants, fiber plants, and medicinal plants used by the native tribes.

In each of these departments the work should be under a trained naturalist, competent to supervise the field work, make the necessary technical studies, and prepare the report relating to his own special line. The chief object of the work should be a complete and authoritative report on the fauna and flora of the islands, comprising descriptions of all the species, with a statement of their geographical ranges. This will lead to a natural classification of the islands according to the origin of the faunas and their relationship to one another and to those of adjacent islands. Attempts thus to group the islands have been made by Wallace, Steere, Worcester, and others, but as yet the faunas and floras are too little known to admit of final judgment.

(9) FORESTRY.

The subject of forestry in the Philippines is one which is both of deep scientific interest and of great importance in the economic development of the islands. A local bureau of forestry has already been instituted by the Philippine Commission, and this will undoubtedly be a permanent organization. It will be needed to protect, control, and foster the extremely valuable timber resources of the islands, and it is already doing good work. There are, however, certain fundamental facts and relations in connection with the forests, which can be ascertained only by a thorough scientific investigation, which is beyond the scope of the local bureau. These studies can be completed within a few years, with the certainty that the knowledge obtained will be of lasting benefit to the local bureau of forestry; and the investigation of these subjects properly belongs to a scientific survey of the archipelago. Such subjects are the sylvicultural organization of the forests; periodicity of growth in tropical trees; processes of seed bearing, seed distribution, and germination; growth and competition in early life; the influence of moisture and temperature on the tropical forest, and the influence of the forest on moisture and temperature. While forestry is, strictly speaking, a branch of botany, its methods are peculiar and it will be expedient to treat it as a separate branch of the scientific surveys.

(10) ANTHROPOLOGY.

Although little is known of the archæology and ethnology of the Philippines, there are sufficient reasons for believing that, in these two closely related lines of research, facts of the greatest importance will be discovered in the archipelago. Indeed it is probable that in southeastern Asia or in the adjacent insular regions the remains of fossil man will be found. The discovery of bones of *Pithecanthropus erectus*, that strange ape-like man or man-like ape, in the Pliocene formation of the Island of Java, leads to the expectation that systematic research in the deposits marking the beginning of the Quaternary period in the Philippines will yield the remains and probably the works of man, and thus throw light on the subject of early man in Asia. The small amount of archæological research thus far accomplished in the islands has already revealed evidence of an apparently aboriginal people differing from the Negritos.

This Negrito race of the islands, with its closest affinities on the Malay Peninsula and the Andaman Islands, offers a problem of exceeding interest and scientific importance. Where did this Negrito race originate? Is it a distinct primitive type that has persisted in the outlying regions of the Asiatic Continent? or is it a differentiated branch of a widely extended primitive race or species of man? These and other important questions may not improbably be answered by an extended anthropological survey of the Philippines.

Linguistic studies of the widest scope should be pursued on the islands. The myths and folklore of the various tribes should receive the attention now demanded by the requirements of science. Collections of archæological material also should be secured as a means of studying the early status of man on the islands; and the effect that the later intrusions have had on the aboriginal peoples ought to be ascertained by a thorough study of the customs, arts, and mental characteristics of the many and diversified tribes.

Knowledge of these matters is essential in order that the proper method of dealing with the natives may be determined. The honor of the United States demands that every means be taken to avoid mistakes of ignorance in dealing with the vast and relatively helpless population of these islands. This first attempt of the United States to bring alien races of the Tropics into the fold of Anglo-Saxon civilization should be guided by strictly scientific data and principles. This necessitates, first, thorough knowledge of the peoples to be assisted, and then measures which accord with their various customs and their capabilities. Only a thoroughly scientific anthropological survey can provide the information required for the attainment of enlightenment and humane results.

(11) COLLECTIONS AND THEIR DISPOSITION.

Each special survey should cooperate as far as practicable with other branches of the service in the collection of specimens, and be ready to afford them all facilities not incompatible with its own efficiency.

The specimens collected will be the property of the United States. The first series, including all type specimens, should be deposited in the United States National Museum. A series of duplicates should be deposited in a local museum in the Philippines, such museum to be designated by the Philippine Commission. Other duplicates, if there be any, should be distributed to such leading museums desiring collections of this character as by reason of permanent endowments are able properly to care for and preserve the specimens.

(12) COMPARATIVE STUDIES IN ADJACENT ISLANDS.

For the purposes of the contemplated surveys Malaysia as a whole constitutes a convenient geological and biological province. A very large amount of valuable scientific investigation has been accomplished in other portions of Malaysia, particularly by Dutch geologists and naturalists. Some of the questions arising in the Philippines can not be satisfactorily settled without comparison of the occurrences in the archipelago with those in adjacent islands. Hence this committee is of opinion that general permission should be granted to the scientific surveys of the Philippine Islands to send observers, from time to time and for brief periods, to neighboring islands for the purpose of making comparative studies. Great saving of time and great increase in efficiency would result from such a provision.

(13) ADMINISTRATION.

The scientific history of the United States during the last fifty years demonstrates the value of unification and systematic organization in such surveys as are contemplated in this report. The State geological surveys were manned by able and industrious observers, but there was a lack of unity of method and a lack of unity of aim, which made it nearly impossible to correlate their results. No one familiar with the subject will question the statement that the country as well as the science of geology has profited by the extension of the United States Geological Survey over the entire country. The national scientific bureaus have, laboriously and after long experience, developed methods of work and staffs of assistants which are at least equal to any in the world. To develop in the Philippines a separate set of similar bureaus would require much time and loss of time. Nor would employment in such bureaus be attractive; for prolonged service in the Tropics is so trying to most constitutions that the number of competent men willing to accept permanent positions there will probably not exceed the demand of the insular administrative bureaus to which reference has been made in a preceding paragraph. On the other hand, there seems no essential difficulty in embracing this area, like any other territory of the United States, in the fields occupied by existing national bureaus. Members of these organizations would be willing to be detailed for two or three years to so interesting a region as the Philippine Islands with the prospect of resuming duty at home.

In order to secure cooperation and to preserve due proportions between the various surveys under the charge of the national bureaus, to arrange for suitable forms of publication of reports, prepare estimates, recommend legislation, determine upon the system of measurements, and to settle other questions of common interest, there must be frequent consultations in Washington between the representatives of the various branches of the work. For this purpose it is suggested that a board of Philippine surveys be created and put in charge of the work. It is manifestly of the utmost importance that such a board should be composed exclusively of eminent scientific experts, who alone are competent to direct the work. For administrative reasons it is essential that the board should consist of officers selected from the national scientific bureaus, and in the opinion of the committee these should be:

- Superintendent of United States Coast and Geodetic Survey.
- Director of United States Geological Survey.
- Chief of United States Biological Survey.
- Botanist of United States Department of Agriculture.
- Chief of Bureau of Forestry.
- Chief of Scientific Staff of Fish Commission.
- Chief of Bureau of American Ethnology.

From these members one should be appointed chairman by the President, with the consent of the Senate, and the chairman should report to the President. There are precedents for such an organization in the Smithsonian Institution and in the boards of commissioners appointed to represent the Government at various expositions.

The chief necessary expense of such a board would be a very moderate sum for clerical assistance; but it would probably be expedient and economical for the board to employ an officer, to be stationed at Manila, to perform functions analogous to those of quartermaster and commissary for all field parties, which will have many material wants in common.

While the methods of work and the selection of men should be left to the chiefs of the national scientific bureaus, viz, the members of the board of Philippine surveys, much latitude must be allowed the officers in charge of field work in so remote and exceptional a region as the Philippine Islands. On the other hand, if these officers are left entirely to their own judgment as to areas in which work is to be done in any given season, and as to the amount of detail requisite, there will be danger of lack of harmony in the results and delay in the progress of the work. To insure cooperation and to avoid duplication in the field work the following plan is suggested:

Let a scientific council be created in the Philippine Islands, presided over by a member of the Philippine Commission, to consist of the chief field officers of the several scientific bureaus present in the islands, as follows:

- One geodeist, designated by the Superintendent of the Coast Survey.
- One hydrographer, designated by the Superintendent of the Coast Survey.
- One topographer, designated by the Director of the Geological Survey.
- One geologist, designated by the Director of the Geological Survey.
- One zoologist, designated by the Chief of the Biological Survey.
- One botanist, designated by the Botanist of the Department of Agriculture.
- One forester, designated by the Chief of the Bureau of Forestry.
- One anthropologist, designated by the Chief of the Bureau of American Ethnology.

With whom should be associated one officer of engineers, United States Army, and one naval officer. Let this council meet once each year, for example, toward the close of the rainy season, and decide, in the interests of the Philippine surveys as a whole, what areas each bureau shall take up during the ensuing season, and with what degree of detail. It is believed that such a council would deal satisfactorily with all matters which might come before it, without lack of due regard to the expert opinions of the chief officers affected. In case of dissatisfaction, however, an appeal might be allowed to the governor-general. The findings of the council should be regularly reported to the board of Philippine surveys in Washington.

(14) AID FROM ARMY AND NAVY.

Except at the largest towns, it is seldom possible in the Philippines to obtain clothing or food such as Americans are accustomed to, and transportation facilities are very limited. For this reason it is recommended that the officers of the scientific surveys be granted permission to purchase supplies at military depots, such as army posts and naval vessels, and to avail themselves of opportunities of transportation on vessels attached to either service when such accommodation can be afforded without detriment to the military service.

(15) COST AND TIME.

This committee is not in a position to offer estimates of the cost of Philippine surveys. These could be easily furnished by the chief officers of the various scientific bureaus. It is believed, however, that with a moderate number of parties in each branch, under the system of cooperation recommended in this report, nearly all the work of exploration outlined above would be completed in a period of ten years, including charts, topographical maps, and geological maps.

(16) ORDER OF IMPORTANCE.

Should it be impracticable to organize the entire system of surveys simultaneously, it is recommended that they receive attention in the following order:

Coast and geodetic work and marine hydrography.
Land topography, including surveys and classification of public lands.
Geology and mineral resources.
Botany.
Systematic forestry.
Zoology.
Anthropology.

This report was adopted by the committee on February 7, 1903.

William H. Brewer, *Chairman.*
George F. Becker, *Secretary.*
C. Hart Merriam.
F. W. Putnam.
R. S. Woodward.

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may,

however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

SEC. 2. The officers of the Academy, together with six members to be elected by the Academy at the first stated session in each year, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

SEC. 3. The president of the Academy, or in case of his absence or inability to act the vice-president, shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The six additional members of the council shall be elected, on any day after the first of the first stated session in each year, by each voter inscribing six names on his ballot, and those six who have received more votes than any others shall be declared elected. If two or more names have received the lowest number of votes that would elect, additional balloting shall be had for as many members as remain each time to be elected until the number is full.

The term of the members so elected shall commence at the close of the session at which they are elected and continue until the close of the first stated session in the next year.

SEC. 4. Nominations of members may be made in writing, signed by any five members of the Academy, at any stated session, to be voted on at the next stated session held in Washington, and each nomination shall, at the time of election, be accompanied by a written list of the original works of the nominee.

SEC. 5. The Academy shall be divided into six standing committees. In this classification a member who is eminent in more than one subject may be assigned to a corresponding number of committees. The classification shall be the following:

1. Mathematics and Astronomy.
2. Physics and Engineering.
3. Chemistry.
4. Geology and Paleontology.
5. Biology.
6. Anthropology.

In nominating for membership in the Academy, a statement must be made as to the subject or subjects in which the person nominated is eminent. Every nomination must be submitted, through the secretary, to all the members of the committee or committees representing the

subject or subjects in which the person nominated is stated to be eminent; and in order that his name may be brought before the Academy for election he must receive the votes of a majority of the members of the committee or committees to which his name has been referred.

Elections for membership shall be held in the following manner: Each member may inscribe on a ballot not more than five names of nominees selected from the list. Absent members may send such ballots to the home secretary. From the seven names receiving the highest number of votes in this preference ballot the members present may proceed to elect new members in the following manner: At each ballot each member present may vote for not exceeding three persons, and the person receiving the highest number of votes shall be declared elected, provided that he receive two-thirds of the votes cast and that his name appear on not less than twenty ballots; and provided further, that the number of members of the Academy be not already one hundred or over, in which case to be declared to be elected he must receive four-fifths of the votes cast, and his name must appear on at least twenty-five ballots.

Should several candidates have the same minimum number of votes on the preference list, the requisite number for completing the list shall be selected from them by a two-thirds vote of the members present.

Election of members shall be held only at the regular stated session of each year held in Washington, and not more than five members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

Sec. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

Sec. 7. Foreign associates may be nominated by a committee of five members, to be appointed for that purpose by the president and elected at any stated session by a two-thirds vote of the members present. The election shall be had by each member indicating on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the ballots shall be declared elected.

Sec. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

Sec. 9. Resignations shall be addressed to the president and acted on by the Academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

SEC. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council, and afterwards to the Academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy, upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with

the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

SEC. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.

7. Other business.

8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of Departments of the Govern-

ment, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1904-5.

	Expiration of term.
Agassiz, Alexander, *President*	April, 1907.
Remsen, Ira, *Vice-President*	April, 1909.
Newcomb, Simon, *Foreign Secretary*	April, 1909.
Hague, Arnold, *Home Secretary*	April, 1907.
Emmons, S. F., *Treasurer*	April, 1908.

ADDITIONAL MEMBERS OF COUNCIL, 1904-5.

Billings, J. S.
Bowditch, H. P.
Brush, G. J.
Hale, George E.
Walcott, C. D.
Welch, W. H.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
   - Abbe, C.
   - Boss, L.
   - Campbell, W. W.
   - Chandler, S. C.
   - Comstock, G. C.
   - Davidson, G.
   - Elkin, W. L.
   - Hale, G. E.
   - Hall, A.
   - Hill, G. W.
   - Holden, E. S.
   - Langley, S. P.
   - Moore, E. H.
   - Newcomb, S.
   - Osgood, W. F.
   - Peirce, C. S.
   - Pickering, E. C.
   - Woodward, R. S.
   - Young, C. A.
2. Physics and Engineering.
   - Abbe, C.
   - Abbot, H. L.
   - Barker, G. F.
   - Barus, C.
   - Bell, A. G.

2. Physics and Engineering—Continued.
   - Comstock, C. B.
   - Hastings, C. S.
   - Langley, S. P.
   - Mendenhall, T. C.
   - Michelson, A. A.
   - Morley, E. W.
   - Nichols, E. L.
   - Pickering, E. C.
   - Trowbridge, J.
   - Webster, A. G.
   - Woodward, R. S.
   - Wright, A. W.
3. Chemistry.
   - Barker, G. F.
   - Brush, G. J.
   - Chandler, C. F.
   - Chittenden, R. H.
   - Crafts, J. M.
   - Dana, E. S.
   - Gibbs, W.
   - Gooch, F. A.
   - Hilgard, E. W.
   - Jackson, C. L.
   - Johnson, S. W.
   - Michael, A.

COMMITTEES OF THE ACADEMY—Continued.

On nominations of new members—Continued.

3. Chemistry—Continued.
Morley, E. W.
Nef, John U.
Penfield, S. L.
Remsen, I.
Richards, T. W.
Smith, E. F.
Wells, H. L.

4. Geology and Paleontology.
Agassiz, A.
Becker, G. F.
Chamberlin, T. C.
Dall, W. H.
Davis, W. M.
Dutton, C. E.
Emmons, S. F.
Gilbert, G. K.
Hague, Arnold.
Osborn, H. F.
Penfield, S. L.
Pumpelly, R.
Van Hise, C. R.
Walcott, C. D.
White, C. A.

5. Biology.
Agassiz, A.
Allen, J. A.
Bowditch, H. P.
Brewer, W. H.
Brooks, W. K.
Chittenden, R. H.
Councilman, W. T.
Dall, W. H.
Farlow, W. G.

5. Biology—Continned.
Gill, T. N.
Goodale, G. L.
Mark, E. L.
Merriam, C. H.
Minot, C. S.
Morse, E. S.
Osborn, H. F.
Prudden, T. M.
Putnam, F. W.
Sargent, C. S.
Scudder, S. H.
Smith, S. I.
Trelease, W.
Verrill, A. E.
Walcott, C. D.
Welch, W. H.
White, C. A.
Whitman, C. O.
Wilson, E. B.
Wood, H. C.

6. Anthropology.
Billings, J. S.
Boas, F.
Cattell, J. McK.
James, Wm.
Minot, C. S.
Merriam, C. H.
Mitchell, S. W.
Morse, E. S.
Peirce, C. S.
Putnam, F. W.
Welch, W. H.

On Weights, Measures, and Coinage.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Newcomb, S.
Peirce, C. S.
Comstock, C. B.
Young, C. A.

On the Election of Foreign Associates.

Remsen, Ira, *Chairman.*
Brush, G. J.
Mitchell, S. W.
Newcomb, S.

On Publication.

The President.
C. D. Walcott.
The Home Secretary.

On Solar Research.

Hale, George E., *Chairman.*
Campbell, W. W.
Young, C. A.
Langley, S. P.
Michelson, A. A.

TRUST FUNDS.

Board of Direction of the Bache Fund.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Chandler, S. C., *Chairman.* Bowditch, H. P.
Remsen, Ira.

Board of Trustees of the Watson Fund.

[1893, residual estate, $18,666.88.]

For the promotion of astronomical research.

Newcomb, S., *Chairman.* Elkin, W. L.
Boss, L.

The Henry Draper Fund.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Pickering, E. C., *Chairman.* Trowbridge, J.
Newcomb, S. Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

[1885, $8,000.]

For the investigation of meteoric bodies.

Brush, G. J., *Chairman.* Johnson, S. W.
Morley, E. W. Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

[1897, $20,000.]

For researches in astronomy.

Hall, Asaph, *Chairman.* Chandler, S. C.
Boss, Lewis.

The Barnard Medal.

Billings, J. S., *Chairman.* Chandler, S. C.
Bowditch, H. P. Jackson, C. L.
Newcomb, S.

The Wolcott Gibbs Fund.

[1893, $2,673,17.]

For chemical research.

Jackson, C. L., *Chairman.* Remsen, Ira.

The Joseph Henry Fund.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others, as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, FEBRUARY 20, 1905.

		Date of election.
Abbe, Cleveland	*2017 I st. NW., Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum, New York City.*	1876
Barker, George F	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Brown University, Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Bowditch, Henry P	*Harvard Medical School, Boston, Mass.*	1887
Brewer, William H	*418 Orange st., New Haven, Conn.*	1880
Brooks, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
Brush, George J	*14 Trumbull st., New Haven, Conn.*	1868
Campbell, William W	*Lick Observatory, Mt. Hamilton, California.*	1902
Cattell, James McK	*Garrison, N. Y.*	1901
Chamberlin, Thomas C	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F	*Columbia University, New York City.*	1874
Chandler, Seth C	*16 Craigie st., Cambridge, Mass.*	1888
Chittenden, Russell H	*Sheffield Scientific School, New Haven, Conn.*	1890
Comstock, Cyrus B., U. S. A	*124 E. Twenty-seventh st., New York City.*	1884
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Councilman, Wm. T	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M	*88 Marlborough st., Boston, Mass.*	1872
Dall, William H	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S	*Yale University, New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Davis, Wm. Morris	*17 Francis ave., Cambridge, Mass.*	1904
Dutton, Clarence E., U. S. A	*Englewood, N. J.*	1884
Elkin, William L	*Yale University Observatory, New Haven, Conn.*	1895
Emmons, Samuel F	*U. S. Geological Survey, Washington, D. C.*	1892
Farlow, W. G	*Harvard University, Cambridge, Mass.*	1879
Gibbs, Wolcott	*Newport, R. I.*	——
Gilbert, Grove K	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A	*Yale University, New Haven, Conn.*	1897
Goodale, George L	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E	*Yerkes Observatory, Williams Bay, Wis.*	1902
Hall, Asaph	*Norfolk, Conn.*	1875
Hastings, Charles S	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W	*University of California, Berkeley, Cal.*	1872
Hill, George W	*West Nyack, N. Y.*	1874
Holden, Edward S	*U. S. Military Academy, West Point, N. Y.*	1885
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
James, William	*95 Irving st., Cambridge, Mass.*	1903
Johnson, Samuel W	*54 Trumbull st., New Haven, Conn.*	1866
Langley, Samuel P	*Smithsonian Institution, Washington, D. C.*	1876
Mark, Edward L	*109 Irving st., Cambridge, Mass.*	1903
Mendenhall, Thomas C	*Worcester, Mass.*	1887

		Date of election.
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A.	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S.	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H.	*University of Chicago, Chicago, Ill.*	1901
Morley, Edward W.	*2238 Euclid ave., Cleveland, Ohio.*	1897
Morse, Edward S.	*P. O. Box 268, Salem, Mass.*	1876
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Newcomb, Simon, U. S. N.	*1620 P st. N. W., Washington, D. C.*	1869
Nichols, Edward L.	*Cornell University, Ithaca, N. Y.*	1901
Osborn, H. F.	*American Museum of Natural History, New York City.*	1900
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Charles S.	*Milford, Pa.*	1876
Penfield, S. L.	*Yale University, New Haven, Conn.*	1900
Pickering, Edward C.	*Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Putnam, Frederick W.	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W.	*Harvard University, Cambridge, Mass.*	1899
Sargent, Charles S.	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scudder, Samuel H.	*Cambridge, Mass.*	1877
Smith, Edgar F.	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Sidney I.	*Yale University, New Haven, Conn.*	1884
Trelease, Wm.	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R.	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E.	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D.	*U. S. Geological Survey, Washington, D. C.*	1896
Webster, Arthur G.	*Clark University, Worcester, Mass.*	1903
Welch, William H.	*935 St. Paul st., Baltimore, Md.*	1895
Wells, Horace L.	*Yale University, New Haven, Conn.*	1903
White, Charles A.	*330 T st. NW., Washington, D. C.*	1889
Whitman, Charles O.	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B.	*Columbia University, New York City.*	1899
Wood, Horatio C.	*1925 Chestnut st., Philadelphia, Pa.*	1879
Woodward, Robert S.	*Columbia University, New York City.*	1896
Wright, Arthur W.	*Yale University, New Haven, Conn.*	1881
Young, Charles A.	*Princeton University, Princeton, N. J.*	1872

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Louis*		Dec. 14, 1873
Alexander, J. H.*		Mar. 2, 1867
Alexander, Stephen*		June 25, 1883
Bache, Alexander Dallas*		Feb. 14, 1867
Baird, Spencer F.*	1864	Aug. 19, 1887
Barnard, F. A. P.		Apr. 27, 1889
Barnard, J. G.*		May 14, 1882

* Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death.
Bartlett, W. H. C.		Feb. 11, 1893
Beecher, Charles Emerson*	1899	Feb. 14, 1904
Brown-Sequard, Charles E.*	1868	Apr. 2, 1894
Casey, Thomas L.*	1890	Mar. 25, 1896
Caswell, Alexis*		Jan. 8, 1887
Chauvenet, William*		Dec. 13, 1870
Clarke, Henry James*	1872	July 1, 1873
Coffin, James H.*	1869	Jan. 6, 1873
Coffin, J. H. C.*		Jan. 8, 1890
Cook, George H.*	1887	Sept. 22, 1889
Cooke, Josiah P.*	1872	Sept. 3, 1894
Cope, Edward D.*	1872	Apr. 12, 1897
Coues, Elliott	1877	Dec. 25, 1899
Dalton, J. C.*	1864	Feb. 2, 1889
Dana, James D.		Apr. 14, 1895
Davis, Charles H.*		Feb. 14, 1877
Draper, Henry*	1877	Nov. 20, 1882
Draper, John W.*	1877	Jan. 4, 1882
Eads, James B.*	1872	Mar. 8, 1887
Engelmann, George*		Feb. 4, 1884
Ferrel, William*	1868	Sept. 18, 1891
Frazer, John Fries*		Oct. 12, 1872
Gabb, William M.*	1876	May 30, 1878
Genth, F. A.*	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gilliss, James Melville*		Feb. 9, 1865
Goode, G. Brown*	1888	Sept. 6, 1896
Gould, Augustus A.*		Sept. 15, 1866
Gould, Benjamin A		Nov. 27, 1896
Gray, Asa*		Jan. 30, 1888
Guyot, Arnold*		Feb. 8, 1884
Hadley, James*	1864	Aug. 1, 1872
Haldeman, S. S.*	1876	Sept. 20, 1880
Hall, James		Aug. 8, 1898
Hayden, F. V.*	1873	Dec. 22, 1887
Henry, Joseph*		May 13, 1878
Hilgard, Julius E.*		May 8, 1891
Hill, Henry B.*	1883	Apr. 6, 1903
Hitchcock, Edward*		Feb. 27, 1864
Holbrook, J. E.*	1868	Sept. 8, 1871
Hubbard, J. S.*		Aug. 16, 1863
Humphreys, A. A.*		Nov. 28, 1883
Hunt, T. Sterry	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Keeler, J. E.*	1900	Aug. 12, 1900
King, Clarence*	1876	Dec. 24, 1901
Kirkland, Jared P.*	1865	Dec. 10, 1877
Lane, J. Homer*	1872	May 3, 1880
Le Conte, John*	1878	Apr. 29, 1891
Le Conte, John L.*		Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carey*	1892	Mar. 15, 1897
Leidy, Joseph		Apr. 30, 1891
Lesley, J. Peter		June 3, 1903
Lesquereux, Leo*	1864	Oct. 25, 1889

* Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death.
Longstreth, Miers F		Dec. 27, 1891
Loomis, Elias*	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore*	1872	Sept. 10, 1897
Mahan, D. H.*		Sept. 16, 1871
Marsh, G. P.*	1866	July 23, 1882
Marsh, O. C	1874	Mar. 18, 1899
Mayer, Alfred M	1872	July 13, 1897
Mayo-Smith, Richmond	1890	Nov. 11, 1901
Meek, F. B.*	1869	Dec. 21, 1877
Meigs, M. C.*	1865	Jan. 2, 1892
Mitchell, Henry	1885	Dec. 1, 1902
Morgan, Lewis H.*	1875	Dec. 14, 1881
Morton, Henry	1874	May 9, 1902
Newberry, J. S.*		Dec. 7, 1892
Newton, H. A.*		Aug. 1, 1896
Newton, John*	1876	May 1, 1895
Norton, William A.*	1873	Sept. 21, 1883
Oliver, James E.*	1872	Mar. 27, 1895
Packard, A. S	1872	Feb. 14, 1905
Peters, C. H. F	1876	July 18, 1890
Pourtales, L. F.*	1873	July 19, 1880
Powell, John W	1880	Sept. 23, 1902
Rodgers, John		May 5, 1882
Rogers, Fairman		Aug. 23, 1900
Rogers, Robert E.*		Sept. 7, 1884
Rogers, Wm. A.*	1885	Mar. 1, 1898
Rogers, William B.*		May 30, 1882
Rood, Ogden N	1885	Nov. 12, 1902
Rowland, Henry A.*	1881	Apr. 16, 1901
Rutherfurd, Lewis M.*		May 30, 1892
Saxton, Joseph*		Oct. 26, 1873
Schott, Charles A	1872	July 31, 1901
Sellers, William	1873	Jrn. 24, 1905
Silliman, Benj., Sr.*		Nov. 24, 1864
Silliman, Benj., Jr		Jan. 14, 1885
Smith, J. Lawrence*	1872	Oct. 12, 1883
Stimpson, William*	1868	May 26, 1873
Strong, Theodore*		Feb. 1, 1869
Sullivant, W. S.*	1873	Apr. 30, 1882
Torrey, John*		Mar. 10, 1873
Totten, J. G.*		Apr. 22, 1864
Trowbridge, William P.*	1872	Aug. 12, 1892
Trumbull, James H	1872	Aug. 5, 1897
Tuckerman, Edward*	1868	Mar. 15, 1886
Walker, Francis A.*	1878	Jan. 5, 1897
Warren, G. K.*	1876	Aug. 8, 1882
Watson, James C.*	1868	Nov. 23, 1880
Watson, Sereno*	1889	Mar. 9, 1892
Winlock, Joseph*		June 11, 1875
Woodward, J. J.*	1873	Aug. 17, 1884
Worthen, A. H.*	1872	May 6, 1888
Wyman, Jeffries*		Sept. 4, 1874

* Biographical notices have been presented of those designated by an asterisk.

FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Backlund, Oskar	*Pulkowa.*
Baeyer, Adolph Ritter von	*Munich.*
Berthelot, M. P. E.	*Paris.*
Boltzmann, Ludwig	*Vienna.*
Bornet, Edouard	*Paris.*
Brögger, W. C	*Christiania.*
Darwin, George H	*Cambridge.*
Ehrlich, Paul	*Frankfurt-am-Main.*
Fischer, Emil	*Berlin.*
Geikie, Sir Archibald	*London.*
Gill, David	*Cape Town*
Hoff, J. H. van't	*Berlin.*
Hooker, Sir J. D	*London.*
Huggins, Sir William	*London.*
Janssen, J	*Paris.*
Kelvin, Lord	*London.*
Klein, Felix	*Göttingen.*
Koch, Robert	*Berlin.*
Kohlrausch, Friedrich	*Berlin.*
Kölliker, Albert von	*Würzburg.*
Kronecker, Hugo	*Bern.*
Lankester, E. Ray	*London.*
Lister, Lord	*London.*
Loewy, Maurice	*Paris.*
Marey, E. J	*Paris.*
Mendeleeff, D. I	*St. Petersburg.*
Moissan, Henri	*Paris.*
Pfeffer, Wilhelm	*Leipzig.*
Picard, Emile	*Paris.*
Poincaré, Henri	*Paris.*
Ramsay, Sir William	*London.*
Rayleigh, Lord	*London.*
Richthofen, F. von	*Berlin.*
Rosenbusch, H	*Heidelberg.*
Strasburger, Edouard	*Bonn.*
Struve, Otto von	*Karlsruhe.*
Suess, Edouard	*Vienna.*
Thomson, Joseph John	*Cambridge.*
Vogel, H. C	*Berlin.*
Vries, Hugo de	*Amsterdam.*
Zirkel, Ferdinand	*Leipzig.*

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.

DECEASED FOREIGN ASSOCIATES—Continued.

C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.
Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekulé.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.
Henri de Lacaze-Duthiers.
Alfred Cornu.
Rudolph von Virchow.
Sir George G. Stokes.
Karl Gegenbaur.
Karl Alfred Ritter von Zittel.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1905.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1906.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1905.

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1906.

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GOVERNMENT PRINTING OFFICE.
1906.

LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE PAST YEAR, 1905.

National Academy of Sciences,
Office of the President,
Washington, D. C., January 2, 1906.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

Alexander Agassiz.

The President of the Senate.

ACT OF INCORPORATION AND AMENDMENTS.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia, J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherfurd, New York, Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut, Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted,* That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882.*

True copies.

SEVELLON A. BROWN,
Chief Clerk.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN,
Chief Clerk.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1905 the Academy held three sessions. The first was the regular annual session held at Washington, April 18 to 20, inclusive; the second, a scientific session held at New Haven, November 14 and 15; the third, a special session held at New Haven, November 15, for the transaction of business.

ANNUAL MEETING.

The session was held at the U. S. National Museum, Washington, with the president, Mr. Alexander Agassiz, in the chair.

The following members were present during the session: Messrs. Agassiz, Allen, Becker, Billings, Boas, Boss, Brewer, Brooks, Brush, Cattell, Chittenden, Councilman, Dall, Davis, Dutton, Emmons, Gill, Hague, Langley, Merriam, Mitchell, Morse, Newcomb, Nichols, Osborn, Peirce, Putnam, Remsen, Walcott, Webster, Welch, Wells, White, Wood, and Woodward.

REPORT OF THE HOME SECRETARY.

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES:

I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 17, 1905.

The annual report of the president of the Academy for 1904 was transmitted to Congress February 20, 1905, through Senator Wetmore, chairman of the Committee on the Library. The usual edition of 500 copies was received from the Public Printer March 29. Of this edition 200 copies have been distributed, including those sent to members of the Academy, our foreign associates, and such libraries as are on our exchange list.

The fifth volume of the biographical memoirs was published during the past winter and a copy furnished to every member of the Academy and to about 200 of the most important reference libraries in the United States. The volume contains biographical sketches of 14 of our deceased members, in every case accompanied by a likeness. The biographies are those of Joseph Henry, J. E. Holbrook, L. F. de Pourtalés, A. A. Gould, H. A. Rowland, Theo. Lyman, M. C. Lea, F. A. Walker, J. G.

Barnard, J. E. Keeler, James Hadley, H. B. Hill, Sereno Watson, and R. E. Rogers.

Part II of Prof. A. S. Packard's work on the bombycine moths will soon be issued as Volume IX of the memoirs of the Academy. Owing to the protracted illness and death of Professor Packard, the work of revising the text and illustrations has been delayed. Mr. Samuel Henshaw, of the Museum of Comparative Zoology, kindly undertook the work of seeing the volume through the press, and in a few weeks the monograph will be mailed to every member of the Academy.

Memoirs I, II, and III, of Volume X are awaiting publication, and it is hoped they will soon be issued from the press of the Government Printing Office.

At the time of the last annual meeting four new members were elected to the Academy. During the past year two members, William Sellers and Alpheus S. Packard, have died, leaving 91 names on the active membership list. The list of our foreign associates numbers 42.

Very respectfully,

Arnold Hague,
Home Secretary.

April 17, 1905,

REPORT OF THE TREASURER.

Washington, D. C., *April 18, 1905.*

The President of the National Academy of Sciences.

Sir: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 18, 1905:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.	Gould fund.	Emmons and Gill, trustees.	Building fund.
Balance brought forward:								
Cash	$290.59	$826.06	$1,703.04	$122.16	$717.50	$656.95	$475.65	$133.12
Invested income	3,500.00	2,000.00	2,993.71		1,496.57	1,000.00		1,500.00
Interest	227.63	2,199.77	1,088.13	417.92	361.00	895.00	15.00	67.50
Members' tax	505.10							
Appropriation returned		306.60	107.50					
Increase from sale of bonds	97.50		292.50					
Total	4,620.82	5,332.43	6,185.18	540.08	2,575.07	2,551.95	490.65	1,700.62
Disbursed	677.51	1,566.06	2,771.50	18.84	215.71	786.01	86.85	1.33
Transfer to Capital fund				450.00				
Balance:								
Cash	443.31	766.37	119.97	71.24	[a] 612.79	765.94	403.80	199.29
Invested income	3,500.00	3,000.00	3,293.71		1,746.57	1,000.00		1,500.00
Total	4,620.82	5,332.43	6,185.18	540.08	2,575.07	2,551.95	490.65	1,700.62

[a] Outstanding obligation, $100.

Very respectfully,

S. F. Emmons, *Treasurer.*

The treasurer's report was referred to an auditing committee consisting of Messrs. Dall and Gill, who after due examination reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer.

Wm. H. Dall.
Theo. N. Gill.

REPORT OF TRUST FUNDS.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND FOR 1904–1905.

The board of directors of the Bache fund herewith present as a matter of courtesy to the Academy, the following statement:

Since the last stated meeting of the Academy, April, 1904, the directors have authorized the following appropriations and payments:

1904.		
May 5.	To H. C. Wood, for investigation on the action of alcohol upon circulation	$300
1905.		
Mar. 27.	To Charles L. Doolittle, being second year's installment of the total appropriation of $1,000 to him, reported to the Academy in April, 1904	500

The board has received from Dr. W. T. Porter the sum of $300 returned as an unused appropriation made and paid to him March 17, 1904.

Respectfully submitted.

Seth C. Chandler.
Ira Remsen.

REPORT OF THE DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND FOR THE ACADEMY YEAR 1904–1905.

The directors of the Benjamin Apthorp Gould fund present the following report:

Since the last stated meeting of the Academy, April, 1904, the directors have authorized the payment to Charles L. Doolittle of the sum of $500, this being the second year's installment of the appropriation of $1,000 made to him and reported to the Academy in April, 1904.

They have also authorized the treasurer to carry the sum of $500 from cash income account to invested income account as an addition to the sinking fund toward meeting the deferred contingent grant of $2,500, reported on page 11 of the Academy's report of 1902.

Respectfully submitted.

Asaph Hall.
Lewis Boss.
Seth C. Chandler.

REPORT OF THE WATSON TRUSTEES.

WASHINGTON, D. C., *April 18, 1905.*

To the NATIONAL ACADEMY OF SCIENCES:

The Watson trustees have the honor to submit the following report:

The only work which has been carried on during the past year has been on tables of the asteroids discovered by James C. Watson, as provided in his bequest. It will be recalled by the Academy that it was found by the trustees impossible to bring this work to completion within any reasonable time unless some competent mathematical astronomer, with a corps of computers at hand, devoted an important part of his time and energies to the work. Under these circumstances an arrangement was made with Professor Leuschner, of the University of California, for placing all the facilities in his hands, and paying all the computers whom he found necessary to carry on the work.

The trustees have much pleasure in reporting that this arrangement has been entirely successful. Tables of ten of the asteroids are approaching completion, and it is estimated by Professor Leuschner that the whole work, that on the lost Æthra excepted, will be ready within two years. For more detailed information a copy of a condensed report by Professor Leuschner is appended hereto.

The trustees can not speak too highly of the value of Professor Leuschner's services in this connection. The most complex problems of theoretical astronomy had to be dealt with on lines which might almost be regarded as new. Professor Leuschner has not only mastered and applied the best methods heretofore known, but has himself improved upon them, critically investigating and revising the basis on which they rest, thus making at the same time important contributions to celestial mechanics. He has at every step made complete and detailed reports of all of his proceedings. Recognizing the fact that the income of the fund would, during the progress of the work, barely provide for the payment of his computers, he has exacted no condition as to his own compensation for the time and labor devoted to the work.

Respectfully submitted.

SIMON NEWCOMB, *Chairman.*

UNIVERSITY OF CALIFORNIA,
BERKELEY ASTRONOMICAL DEPARTMENT,
April 8, 1905.

A CONDENSED REPORT ON THE CONDITION OF THE WATSON WORK ON APRIL 1, 1905.

Prof. SIMON NEWCOMB, *1620 P street, Washington, D. C., for the National Academy of Sciences.*

MY DEAR PROFESSOR NEWCOMB: The regular reports so far submitted to the Watson trustees cover more than 100 typewritten pages, and set forth in detail the work that has been accomplished up to April 1, 1905. In the present report I shall therefore confine myself to a brief statement of the present condition of the asteroid work.

A similar report was submitted two years ago. At that time the asteroid work received a serious interruption of about eight months, due to various changes in the staff of the Berkeley astronomical department and to the difficulty of securing efficient computers. With the arrival of Dr. Burt L. Newkirk in the latter part of September, 1903, the work was again regularly taken up, with Doctor Newkirk and Miss Hobe as computers.

The first work undertaken was an investigation of the discrepancies between the observed places of planet 93, Minerva, and those computed by Eichelberger from his perturbations and tables. After considerable fruitless search for an error in the work, the perturbations of Minerva were recomputed with satisfactory results. A motion of the node was discovered, which considerably improved the results. Mr. Eichelberger's numerical work was found to be entirely correct, but the programme of the work was found not to be consistent with the accuracy aimed at.

At the same time, with the perturbations of Minerva, the perturbations of (115) Thyra were computed by Hansen's method. This brought the list of asteroids for which perturbations, inclusively of the constants of integration, have been determined by the Berkeley astronomical department, up to 12.

Asteroids (119) Althaea and (103) Hera were then taken up. Perturbations and tables had been computed for these by Ritter, and Ross had made a comparison of the theory with the observations for the purpose of correcting the elements, but found that the residuals could not be much improved. A determination of a possible motion of the node was therefore taken up, but it was found that the discrepancies could not be accounted for by a motion of the node.

The next step in the work was to prepare a complete programme for the tabulation of the perturbations of all of the asteroids, and considerable work in carrying out this programme has since been done. The first step of all in this connection was the collection of the necessary observations for all of the observed oppositions of all of the Watson asteroids. For the 12 planets for which perturbations have been computed here, observations were then selected with great care for the correction of the elements. For this purpose it was necessary to investigate the observations of nearly 130 oppositions by comparison with ephemerides and with each other. At this point Doctor Newkirk and Miss Hobe were assigned only such portions of the work as required technical preparation, a great part of the numerical work being left to piece computers employed at a cheap rate (30 cents per hour). All computations were made in duplicate. In order to compute the perturbations for the selected observations, such portions of the tables as would not be affected by a correction of the elements were constructed first, and then the perturbations were taken out for all of the 12 planets concerned, and the places computed for each opposition and compared with the observations. The necessary differential coefficients for the least square reduction were then computed by Bauschinger's method and the residuals in α and δ decomposed into residuals in and perpendicular to the plane of the orbit. The solution of the resulting equations of condition by the method of least squares for these 12 planets is completed and the residuals resulting from the least square solutions prove the correctness of the calculation.

The difficulties involved in the asteroid work are not merely numerical, but much time and energy has to be devoted to theoretical questions so as to produce for each planet the best possible result. Theoretical difficulties are somewhat lessened by the fact that the programme of the Watson trustees calls for tables which give the perturbations only to one-tenth of a minute, but even first-order perturbations are not sufficient for this purpose in some cases, no matter what method of determining the perturbations is used. It must be expected that as the calculation progresses, unforeseen difficulties arise which cause an unavoidable retardation. On that account I am now pushing forward the work on what might be termed the clear cases, so as to carry those to a rapid conclusion.

It has been found that in certain cases the perturbations need correction, owing to the large corrections to the elements resulting from the least square solution, but it is hoped that these corrections to the perturbations can be determined differentially by certain formulæ which I have derived for the purpose. This, however, may not be possible in cases like (121) Hermione and (104) Clymene, in which latter case the largest term in nz amounts to about 4°.5. In many cases it is necessary to make two approximations to the corrections to the elements by successive corrections of the perturbations and least square reductions. There seems to be good reason to believe that tables for some ten planets will be ready for publication at the end of the summer months, and that the whole work can be wound up in from eighteen months to two years at the rate of progress hitherto made.

In conclusion, I present the following synopsis of the present condition of the work on each of the Watson asteroids.

Twelve asteroids.—We have fully completed the expressions for $n\delta z$, ν, *and* $u \cos i$ for the perturbations, collected the observations, taken out the perturbations, etc., and have corrected the elements of the following 12 asteroids:

(93) Minerva
(104) Clymene.
(105) Artemis.
(115) Thyra.
(121) Hermione.
(128) Nemesis.
(133) Cyrene.
(139) Juewa.
(150) Nuwa.
(161) Athor.
(174) Phædra.
(179) Clytemnestra.

Three asteroids.—(106) Dione, (168) Sybilla and (175) Andromache belong to the group ½, and special tables for this group were prepared at Berkeley after Bohlin. Through discrepancies between our results and those of Bohlin certain errors in Bohlin's work were discovered after considerable investigation. Further investigation will be necessary owing to additional discrepancies in our tables, those of Bohlin and those of v. Zeipel. These investigations are still under way.

Two asteroids.—(119) Althæa and (103) Hera. Perturbations and tables complete (by Ritter). Results not satisfactory, as appears from comparison of observations with theory by Ross. Further investigation necessary to discover cause of discrepancy.

One asteroid.—(79) Eurynome. Perturbations by Becker, tables by Eichelberger. It seems that final comparison between observations and theory has not yet been made. It is therefore not possible to state at present whether the results so far obtained are satisfactory.

One asteroid.—(101) Helene. Perturbations and tables by Ritter. Complete. Comparison between observations and theory indicates that improvement is possible. Investigation of discrepancy desirable. Such investigation commenced by Lawton but not completed.

Two asteroids.—(94) Aurora and (100) Hekate. We supposed that these asteroids had already been taken up by others, but no computations or results referring to these planets are available, and their perturbations will, therefore, have to be computed here.

One asteroid.—(132) Aethra, lost planet. Fate of this planet is under investigation by Miss Hobe for her doctor's dissertation. (Twenty-two asteroids.)

In order to make the results of our work available as soon as possible, Professor Newcomb and I have agreed that the tables of the perturbations should be printed first, and that the necessary account of the work and the various investigations undertaken on each planet should be printed subsequently.

Very respectfully submitted.

Armin O. Leuschner.

REPORT OF THE COMMITTEE ON THE BARNARD MEDAL.

The committee on the Barnard medal respectfully recommend that Prof. Henri Becquerel, of Paris, member of the Institute, be recommended by the National Academy of Sciences to the trustees of Columbia University as the proper recipient of the Barnard medal to be awarded next June. In making this recommendation the committee has borne in mind not only the important discoveries in the field of radio-activity made by Professor Becquerel during the last five years, but also the fact that he was the original discoverer of the so-called dark rays from uranium, which discovery has been the basis of subsequent research into and of our present knowledge of the laws of radio-activity.

Respectfully submitted.

J. S. Billings.
S. Newcomb.
E. L. Nichols.

ELECTIONS.

Messrs. Welch, Hale, Woodward, Chittenden, Osborn, and Billings were elected members of the council.

Messrs. Arthur A. Noyes, Michael I. Pupin, John C. Branner, William H. Holmes, and William H. Howell were elected members of the Academy.

Henri Becquerel, of Paris, and Paul von Groth, of Munich, were elected foreign associates of the Academy.

DEATHS.

Two members of the Academy died during the year 1905: William Sellers, January 24, and Alpheus S. Packard, February 14.

Four foreign associates died during the year: E. J. Marey, Otto von Struve, Ferdinand Freiherr von Richthofen, and Albert von Kölliker.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

The Geographical Cycle in an Arid Climate. William M. Davis.

The Mechanical Equivalent of Light. Edward L. Nichols.

The Effects of Alcohol upon the Circulation. H. C. Wood and Daniel M. Hoyt.

The Axis of Symmetry of the Ovarian Egg of the Oyster. W. K. Brooks.

The Expedition of the U. S. Fish Commission Steamer *Albatross*, in charge of Alexander Agassiz, in the Eastern Pacific, Lieut. Commander L. M. Garrett, commanding. Alexander Agassiz.

A Catalogue of Spectroscopic Binary Stars. W. W. Campbell and Heber D. Curtis.

Discovery of the Sixth and Seventh Satellites of Jupiter, and their Approximate Orbits. C. D. Perrine. (Introduced by W. W. Campbell.)

Resequent Valleys. William M. Davis.

ANNOUNCEMENTS.

The president announced the appointment of Mr. R. S. Woodward as a member of the committee on weights, measures, and coinage; of Mr. George E. Hale as a member of the committee on the Henry Draper fund, in place of Mr. E. C. Pickering, resigned; of Mr. Edward L. Nichols as a member of the committee on the Barnard medal in place of Mr. William Sellers, deceased; and of Mr. Edward F. Smith as a member of the committee on the Wolcott Gibbs fund, in place of Mr. T. M. Drown, deceased.

The president also announced the appointment of Mr. William Trelease as a delegate to the International Botanical Congress to be held at Vienna, June 11 to 18, 1905; and of Messrs. George E. Hale and W. W. Campbell as delegates to represent the Academy on the solar research committee to meet in Oxford in September, 1905.

AMENDMENT TO RULES.

Rule IX was amended by adding the following paragraph:

Before publication all memoirs must be referred to the committee on publication, who may if they deem best refer any memoir to a special committee appointed by the president to determine whether the same should be published by the Academy.

AUTUMN MEETING OF THE ACADEMY.

SCIENTIFIC SESSION.

[Held in New Haven, November 14 and 15, 1905.]

A scientific session for the reading of papers having been called by the council, the Academy met at the Sheffield Scientific School, of Yale University, New Haven, November 14 and 15, 1905.

President Agassiz presided at the sessions and the following members were in attendance: Messrs. Barus, Boas, Brewer, Brush, Cattell, Chandler (C. F.), Chittenden, Dana, Davis, Elkin, Gooch, Hague, Hall, Hastings, Johnson, Minot, Morse, Noyes, Osborn, Peirce, Penfield, Trowbridge, Verrill, Webster, Wells, Wilson, Wright.

The following papers were presented:

Studies on the Chemical Physiology of Development and Growth. L. B. Mendel. (Introduced by R. H. Chittenden.)

On a New Mineral from Borax Lake, California. S. L. Penfield.

Relation of the True Anomalies in a Parabola and a Very Eccentric Ellipse having the Same Perihelion Distance. A. Hall.

On Errors of Eccentricity and Collimation in the Human Eye. F. E. Beach. (Introduced by C. S. Hastings.)

On Pearson's Formulas of Skew Distribution of Variates. Franz Boas.

Sex-determination and the Chromosomes. E. B. Wilson.

The Dwyka Glacial Conglomerate of South Africa. W. M. Davis.

The Disintegration Products of Thorium as indicated by the Proportions of Lead and Helium in Minerals. B. B. Boltwood. (Introduced by H. L. Wells.)

The Relation of Betweenness and Royce's O-collections. C. S. Peirce.

Some Problems in Metallic Reflection. L. P. Wheeler. (Introduced by C. S. Hastings.)

Further Observations on Sedimentation. W. H. Brewer.

The Effect of Roentgen Rays on Certain Metals. H. A. Bumstead. (Introduced by C. S. Hastings.)

On the Variation in the Spines of Sea Urchins. A. Agassiz.

BUSINESS MEETING.

[New Haven, November 14, 1905.]

Mr. Agassiz stated to the Academy that at the last council meeting he had offered to hand over to the treasurer of the Academy the sum of $5,000, or bonds to the value of $5,000, approved by the treasurer on the following conditions: That the sum of $5,000 subscribed by him to the building fund be credited to the general fund, the income to be used for general purposes of the Academy, but that the capital be available for the building fund whenever it is needed for that purpose, and that Mr. Billings had moved in the council that the offer of Mr. Agassiz be accepted with thanks, and that the treasurer be authorized to accept the same in the name of the Academy.

The president appointed Messrs. Brooks, Cattell, James, Newcomb, and Osborn as a committee to report to the council on the relations of the Academy to the philosophical, economic, historical and philological sciences.

The president announced the death of Baron F. von Richthofen, of Berlin, a foreign associate.

Mr. Agassiz presented the following report from the committee appointed by the council to consider the question of aiding the work of the International Association for Seismological Observations:

SEISMOLOGY.

Seismology is a field of geophysical research of the very first importance, but it still remains in a very rudimentary stage of development. Under ideal conditions, earthquake shocks should afford the means of sounding the very depths of the earth, and of determining the physical constants of the component materials of the globe along an endless number of chords or curvilinear paths between the centers of shock and observing stations. Even under present conditions, a considerable amount of interest attaches to seismological observations, and it is possible to determine the latitude and longitude of centers of shock. This achievement, however, is far short of what the method should be capable of yielding, nor does it seem possible, under present conditions, to obtain results radically different from those which have already been reached.

The theoretical basis for seismology is very imperfect. The interpretation of even very perfect observations on the intensity and direction of waves of transmission must depend on the mathematical theory of the vibrations of a sphere in which the elastic properties vary continuously or discontinuously with the distance from the center. There appears to be no reason to doubt that mathematical physicists could, with sufficient labor, develop such a theory with sufficient fullness to act as a guide in the interpretation of observations. This work, however, yet remains to be done. We consulted Sir George H. Darwin on the subject, and he referred us to Professor Chree, of Richmond, who, in Darwin's opinion, is the first authority on the subject of the vibrations of a sphere. Professor Chree informed us that our impression was entirely correct, and that the theory had been insufficiently elaborated as yet.

Even, however, had the necessary theoretical work been done, it would still be impracticable to use such observations as are now being made upon earthquake shocks. Wiechert's seismometer possesses extraordinary delicacy, quite sufficient for any needs yet known or likely to become known, so far as the horizontal components of the movements due to earthquakes are concerned. This, however, is entirely insufficient. It is almost unthinkable that formulas should ever be developed by mathematicians which should be applicable to earthquake shocks, unless the angle of emergence of the waves from the surface of the earth is known, as well as the azimuth of the movement. Many attempts have been made to contrive a seismometer which should record the vertical components of the shock. Hitherto, however, the success attained has been very small, and seismometers of this description record only very heavy shocks of an entirely different order of magnitude from that to which the horizontal instruments are sensitive.

It would seem to follow, therefore, that seismometry is open to improvement in two directions, and that the efforts of geophysicists interested in this subject should be directed accordingly. On the one hand, some able mathematical physicist should be commissioned to elaborate the theory of vibrations in a sphere in which elastic properties and density vary with the radius; and on the other hand, experimental physicists should make strenuous efforts to devise a seismometer capable of recording the vertical components of small shocks. Only when such an instrument is perfected can we begin to make observations which are capable of physical interpretation.

If the day ever comes when the theory and the seismometric apparatus are perfected, field observations can be undertaken, but only under certain conditions. It is in vain to attempt seismometric observations in the neighborhood of artificial disturbing causes. The jar of heavy machinery would be recorded by seismometers, as well as distant earthquake shocks, and even the beating of the waves on a rock-bound coast will affect seismometers at a distance of scores of miles. Hence to investigate the interior of the earth and the origin of earthquakes seismometrically, a series of stations should be selected, well distributed with reference to the earth's surface and in positions as remote as possible from disturbing causes of any description. We have long since dreamed of seeing such a station established in one of the branches of the Mammoth Cave, and have even gone so far as to ascertain that the owners of the Mammoth Cave would gladly give up some gallery or chamber to such a use. Seismometric stations could not profitably be established at large laboratories where machinery is employed. Thus a geophysical laboratory might be selected as the administrative center for a series of seismological stations; observations could there be discussed and instruments invented or tested, but the actual field work would necessarily be performed at localities far removed from such center.

In our opinion it would be expedient for the National Academy to recommend to the Carnegie Institution grants for the development of the theory of vibrations and for experiments designed to lead to the invention of a vertical seismograph. It does not appear to us that the time has come to expend money on observing stations, nor that it will come until the preliminaries indicated above have been adequately dealt with.

(Signed.)

George F. Becker.
A. Agassiz.

November, 1905.

The report was adopted by the Academy.

The home secretary was instructed to forward a copy of the report to the Carnegie Institution for its information and guidance.

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

SEC. 2. The officers of the Academy, together with six members to be elected by the Academy at the first stated session in each year, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

SEC. 3. The president of the Academy, or in case of his absence or inability to act the vice-president, shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The six additional members of the council shall be elected, on any day after the first of the first stated session in each year, by each voter inscribing six names on his ballot, and those six who have received more votes than any others shall be declared elected. If two or more names have received the lowest number of votes that would elect, additional balloting shall be had for as many members as remain each time to be elected until the number is full.

The term of the members so elected shall commence at the close of the session at which they are elected and continue until the close of the first stated session in the next year.

SEC. 4. Nominations of members may be made in writing, signed by any five members of the Academy, at any stated session, to be voted on at the next stated session held in Washington, and each nomination shall, at the time of election, be accompanied by a written list of the original works of the nominee.

SEC. 5. The Academy shall be divided into six standing committees. In this classification a member who is eminent in more than one subject may be assigned to a corresponding number of committees. The classification shall be the following:

1. Mathematics and astronomy.
2. Physics and engineering.
3. Chemistry.
4. Geology and paleontology.
5. Biology.
6. Anthropology.

In nominating for membership in the Academy, a statement must be made as to the subject or subjects in which the person nominated is eminent. Every nomination must be submitted, through the secretary, to all the members of the committee or committees representing the subject or subjects in which the person nominated is stated to be eminent; and in order that his name may be brought before the Academy for election he must receive the votes of a majority of the members of the committee or committees to which his name has been referred.

Elections for membership shall be held in the following manner: Each member may inscribe on a ballot not more than five names of nominees selected from the list. Absent members may send such ballots to the home secretary. From the seven names receiving the highest number of votes in this preference ballot the members present may proceed to elect new members in the following manner: At each ballot each member present may vote for not exceeding three persons, and the person receiving the highest number of votes shall be declared elected, provided that he receive two-thirds of the votes cast and that his name appear on not less than twenty ballots; and provided further, that the number of members of the Academy be not already one hundred or over, in which case to be declared to be elected he must receive four-fifths of the votes cast, and his name must appear on at least twenty-five ballots.

Should several candidates have the same minimum number of votes on the preference list, the requisite number for completing the list shall be selected from them by a two-thirds vote of the members present.

Election of members shall be held only at the regular stated session of each year held in Washington, and not more than five members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. Foreign associates may be nominated by a committee of five members, to be appointed for that purpose by the president and elected at any stated session by a two-thirds vote of the members present. The election shall be had by each member indicating on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the ballots shall be declared elected.

SEC. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the Academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

SEC. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council, and afterwards to the Academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy, upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

SEC. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make

scientific investigations at the request of Departments of the Government, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1905-6.

	Expiration of term.
Agassiz, Alexander, *President*	April, 1907.
Remsen, Ira, *Vice-President*	April, 1909.
Newcomb, Simon, *Foreign Secretary*	April, 1909.
Hague, Arnold, *Home Secretary*	April, 1907.
Emmons, S. F., *Treasurer*	April, 1908.

ADDITIONAL MEMBERS OF COUNCIL, 1905-6.

Billings, J. S.
Chittenden, R. H.
Hale, George E.
Osborn, H. F.
Welch, W. H.
Woodward, R. S.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
   - Abbe, C.
   - Boss, L.
   - Campbell, W. W.
   - Chandler, S. C.
   - Comstock, G. C.
   - Davidson, G.
   - Elkin, W. L.
   - Hale, G. E.
   - Hall, A.
   - Hill, G. W.
   - Holden, E. S.
   - Langley, S. P.
   - Moore, E. H.
   - Newcomb, S.
   - Osgood, W. F.
   - Peirce, C. S.
   - Pickering, E. C.
   - Webster, A. G.
   - Woodward, R. S.
   - Young, C. A.
2. Physics and Engineering.
   - Abbe, C.
   - Abbot, H. L.
   - Barker, G. F.
   - Barus, C.

Physics and Engineering—Continued.
   - Bell, A. G.
   - Comstock, C. B.
   - Hastings, C. S.
   - Langley, S. P.
   - Mendenhall, T. C.
   - Michelson, A. A.
   - Morley, E. W.
   - Nichols, E. L.
   - Noyes, A. A.
   - Pickering, E. C.
   - Pupin, M. I.
   - Trowbridge, J.
   - Webster, A. G.
   - Woodward, R. S.
   - Wright, A. W.

3. Chemistry.
   - Barker, G. F.
   - Brush, G. J.
   - Chandler, C. F.
   - Chittenden, R. H.
   - Crafts, J. M.
   - Dana, E. S.
   - Gibbs, W.
   - Gooch, F. A.
   - Hilgard, E. W.

COMMITTEES OF THE ACADEMY—Continued.

On nomination of new members—Continued.

Chemistry—Continued.
- Jackson, C. L.
- Johnson, S. W.
- Michael, A.
- Morley, E. W.
- Nef, John U.
- Noyes, A. A.
- Penfield, S. L.
- Remsen, I.
- Richards, T. W.
- Smith, E. F.
- Wells, H. L.

4. Geology and Paleontology.
- Agassiz, A.
- Becker, G. F.
- Branner, J. C.
- Chamberlin, T. C.
- Dall, W. H.
- Davis, W. M.
- Dutton, C. E.
- Emmons, S. F.
- Gilbert, G. K.
- Hague, Arnold.
- Osborn, H. F.
- Penfield, S. L.
- Pumpelly, R.
- Van Hise, C. R.
- Walcott, C. D.
- White, C. A.

5. Biology.
- Agassiz, A.
- Allen, J. A.
- Bowditch, H. P.
- Brewer, W. H.
- Brooks, W. K.
- Chittenden, R. H.
- Councilman, W. T.

Biology—Continued.
- Dall, W. H.
- Farlow, W. G.
- Gill, T. N.
- Goodale, G. L.
- Howell, W. H.
- Mark, E. L.
- Merriam, C. H.
- Minot, C. S.
- Morse, E. S.
- Osborn, H. F.
- Prudden, T. M.
- Putnam, F. W.
- Sargent, C. S.
- Scudder, S. H.
- Smith, S. I.
- Trelease, W.
- Verrill, A. E.
- Walcott, C. D.
- Welch, W. H.
- White, C. A.
- Whitman, C. O.
- Wilson, E. B.
- Wood, H. C.

6. Anthropology.
- Billings, J. S.
- Boas, F.
- Cattell, J. McK.
- Holmes, W. H.
- James, Wm.
- Minot, C. S.
- Merriam, C. H.
- Mitchell, S. W.
- Morse, E. S
- Peirce, C. S.
- Putnam, F. W.
- Welch, W. H.

On Weights, Measures, and Coinage.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Newcomb, S.
Peirce, C. S.
Comstock, C. B.
Young, C. A.
Woodward, R. S.

On the Election of Foreign Associates.

Remsen, Ira, *Chairman.*
Brush, G. J.
Mitchell, S. W.
Newcomb, S.

On Publication.

The President.
The Home Secretary.
C. D. Walcott.

COMMITTEES OF THE ACADEMY—Continued.

On Solar Research.

Hale, George E., *Chairman.*
Langley, S. P.
Campbell, W. W.
Michelson, A. A.
Young, C. A.

TRUST FUNDS.

Board of Direction of the Bache Fund.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Chandler, S. C., *Chairman.*
Bowditch, H. P.
Remsen, Ira.

Board of Trustees of the Watson Fund.

[1893, residual estate, $18,666.88.]

For the promotion of astronomical research.

Newcomb, S., *Chairman.*
Elkin, W. L.
Boss, L.

The Henry Draper Fund.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Newcomb, S., *Chairman.*
Trowbridge, J.
Hale, G. E.
Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

[1885, $8,000.]

For the investigation of meteoric bodies.

Brush, G. J., *Chairman.*
Johnson, S. W.
Morley, E. W.
Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

[1897, $20,000.]

For researches in astronomy.

Hall, Asaph, *Chairman.*
Chandler, S. C.
Boss, Lewis.

The Barnard Medal.

Billings, J. S., *Chairman.*
Jackson, C. L.
Bowditch, H. P.
Newcomb, S.
Chandler, S. C.
Nichols, E. L.

The Wolcott Gibbs Fund.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman.*
Remsen, Ira.
Smith, Edgar F.

TRUST FUNDS—Continued.

The Joseph Henry Fund.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others, as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES.

JANUARY 2, 1906.

		Date of election.
Abbe, Cleveland	*2017 I st. NW., Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum, New York City.*	1876
Barker, George F	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Brown University, Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Bowditch, Henry P	*Harvard Medical School, Boston, Mass.*	1887
Branner, John C	*Stanford University, California.*	1905
Brewer, William H	*418 Orange st., New Haven, Conn.*	1880
Brooks, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
Brush, George J	*14 Trumbull st., New Haven, Conn.*	1868
Campbell, William W	*Lick Observatory, Mt. Hamilton, California.*	1902
Cattell, James McK	*Garrison, N. Y.*	1901
Chamberlin, Thomas C	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F	*Columbia University, New York City.*	1874
Chandler, Seth C	*16 Craigie st., Cambridge, Mass.*	1888
Chittenden, Russell H	*Sheffield Scientific School, New Haven, Conn.*	1890
Comstock, Cyrus B., U. S. A	*124 E. Twenty-seventh st., New York City.*	1884
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Councilman, Wm. T	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M	*88 Marlborough st., Boston, Mass.*	1872
Dall, William H	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S	*Yale University, New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Davis, William Morris	*17 Francis ave., Cambridge, Mass.*	1904
Dutton, Clarence E., U. S. A	*Englewood, N. J.*	1884
Elkin, William L	*Yale University Observatory, New Haven, Conn.*	1895
Emmons, Samuel F	*U. S. Geological Survey, Washington, D. C.*	1892
Farlow, W. G	*Harvard University, Cambridge, Mass.*	1879
Gibbs, Wolcott	*Newport, R. I.*	——
Gilbert, Grove K	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N	*Smithsonian Institution, Washington, D. C.*	1873

		Date of election.
Gooch, Frank A	*Yale University, New Haven, Conn.*	1897
Goodale, George L	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E	*Solar Observatory, Mount Wilson, Cal.*	1902
Hall, Asaph	*Norfolk, Conn.*	1875
Hastings, Charles S	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W	*University of California, Berkeley, Cal.*	1872
Hill, George W	*West Nyack, N. Y.*	1874
Holden, Edward S	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H	*Bureau of American Ethnology, Washington, D. C.*	1905
Howell, William H	*232 W. Lanvale st., Baltimore, Md.*	1905
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
James, William	*95 Irving st., Cambridge, Mass.*	1903
Johnson, Samuel W	*54 Trumbull st., New Haven, Conn.*	1866
Langley, Samuel P	*Smithsonian Institution, Washington, D. C.*	1876
Mark, Edward L	*109 Irving st., Cambridge, Mass.*	1903
Mendenhall, Thomas C	*Worcester, Mass.*	1887
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H	*University of Chicago, Chicago, Ill.*	1901
Morley, Edward W	*Adelbert College, Cleveland, Ohio.*	1897
Morse, Edward S	*P. O. Box 268, Salem, Mass.*	1876
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Newcomb, Simon, U. S. N	*1620 P st. NW., Washington, D. C.*	1869
Nichols, Edward L	*Cornell University, Ithaca, N. Y.*	1901
Noyes, Arthur A	*Massachusetts Institute of Technology, Boston, Mass.*	1905
Osborn, H. F	*American Museum of Natural History, New York City.*	1900
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Charles S	*Milford, Pa.*	1876
Penfield, S. L	*Yale University, New Haven, Conn.*	1900
Pickering, Edward C	*Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Pupin, Michael I	*Columbia University, New York City.*	1905
Putnam, Frederick W	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W	*Harvard University, Cambridge, Mass.*	1899
Sargent, Charles S	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scudder, Samuel H	*Cambridge, Mass.*	1877
Smith, Edgar F	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Sidney I	*Yale University, New Haven, Conn.*	1884
Trelease, Wm	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D	*U. S. Geological Survey, Washington, D. C.*	1896
Webster, Arthur G	*Clark University, Worcester, Mass.*	1903
Welch, William H	*807 St. Paul st., Baltimore, Md.*	1895
Wells, Horace L	*Yale University, New Haven, Conn.*	1903

		Date of election.
White, Charles A.	*330 T st. NW., Washington, D. C.*	1889
Whitman, Charles O.	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B.	*Columbia University, New York City.*	1899
Wood, Horatio C.	*1925 Chestnut st., Philadelphia, Pa.*	1879
Woodward, Robert S	*Carnegie Institution, Washington, D. C.*	1896
Wright, Arthur W	*Yale University, New Haven, Conn.*	1881
Young, Charles A.	*36 North Main st., Hanover, N. H.*	1872

FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Backlund, Oskar	*Pulkowa.*
Baeyer, Adolph Ritter von	*Munich.*
Becquerel, Henri	*Paris.*
Berthelot, M. P. E.	*Paris.*
Boltzmann, Ludwig	*Vienna.*
Bornet, Edouard	*Paris.*
Brögger, W. C	*Christiania.*
Darwin, Sir George	*Cambridge.*
Ehrlich, Paul	*Frankfurt-am-Main*
Fischer, Emil	*Berlin.*
Geikie, Sir Archibald	*London.*
Gill, Sir David	*Cape Town.*
Groth, Paul von	*Munich.*
Hoff, J. H. van't	*Berlin.*
Hooker, Sir J. D.	*London.*
Huggins, Sir William	*London.*
Janssen, J	*Paris.*
Kelvin, Lord	*London.*
Klein, Felix	*Gottingen.*
Koch, Robert	*Berlin.*
Kohlrausch, Friedrich	*Marburg.*
Kronecker, Hugo	*Bern.*
Lankester, E. Ray	*London.*
Lister, Lord	*London.*
Loewy, Maurice	*Paris.*
Mendeleeff, D. I	*St. Petersburg.*
Moissan, Henri	*Paris.*
Pfeffer, Wilhelm	*Leipzig.*
Picard, Emile	*Paris.*
Poincaré, Henri	*Paris.*
Ramsay, Sir William	*London.*
Rayleigh, Lord	*London.*
Rosenbusch, H	*Heidelberg.*
Strasburger, Edouard	*Bonn.*
Suess, Edouard	*Vienna.*
Thomson, Joseph John	*Cambridge.*
Vogel, H. C.	*Berlin.*
Vries, Hugo de	*Amsterdam.*
Zirkel, Ferdinand	*Leipzig.*

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Louis*		Dec. 14, 1873
Alexander, J. H.*		Mar. 2, 1867
Alexander, Stephen*		June 25, 1883
Bache, Alexander Dallas*		Feb. 14, 1867
Baird, Spencer F.*	1864	Aug. 19, 1887
Barnard, F. A. P.		Apr. 27, 1889
Barnard, J. G.*		May 14, 1882
Bartlett, W. H. C		Feb. 11, 1893
Beecher, Charles Emerson*	1899	Feb. 14, 1904
Brown-Sequard, Charles E.*	1868	Apr. 2, 1894
Casey, Thomas L.*	1890	Mar. 25, 1896
Caswell, Alexis*		Jan 8, 1887
Chauvenet, William*		Dec. 13, 1870
Clarke, Henry James*	1872	July 1, 1873
Coffin, James H.*	1869	Jan. 6, 1873
Coffin, J. H. C.*		Jan. 8, 1890
Cook, George H.*	1887	Sept. 22, 1889
Cooke, Josiah P.*	1872	Sept. 3, 1894
Cope, Edward D.*	1872	Apr. 12, 1897
Coues, Elliott	1877	Dec. 25, 1899
Dalton, J. C.*	1864	Feb. 2, 1889
Dana, James D		Apr. 14, 1895
Davis, Charles H.*		Feb. 14, 1877
Draper, Henry*	1877	Nov. 20, 1882
Draper, John W.*	1877	Jan. 4, 1882
Eads, James B.*	1872	Mar. 8, 1887
Engelmann, George*		Feb. 4, 1884
Ferrel, William*	1868	Sept. 18, 1891
Frazer, John Fries*		Oct. 12, 1872
Gabb, William M.*	1876	May 30, 1878
Genth, F. A.*	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gilliss, James Melville*		Feb. 9, 1865
Goode, G. Brown*	1888	Sept. 6, 1896
Gould, Augustus A.*		Sept. 15, 1866
Gould, Benjamin A		Nov. 27, 1896
Gray, Asa*		Jan. 30, 1888
Guyot, Arnold*		Feb. 8, 1884
Hadley, James*	1861	Aug. 1, 1872
Haldeman, S. S.*	1876	Sept. 20, 1880
Hall, James		Aug. 8, 1898
Hayden, F. V.*	1873	Dec. 22, 1887
Henry, Joseph*		May 13, 1878
Hilgard, Julius E.*		May 8, 1891
Hill, Henry B.*	1883	Apr. 6, 1903
Hitchcock, Edward*		Feb. 27, 1864
Holbrook, J. E.*	1868	Sept. 8, 1871
Hubbard, J. S.*		Aug. 16, 1863
Humphreys, A. A.*		Nov. 28, 1883
Hunt, T. Sterry	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Keeler, J. E.*	1900	Aug. 12, 1900
King, Clarence*	1876	Dec. 24, 1901
Kirkland, Jared P.*	1865	Dec. 10, 1877

* Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death
Lane, J. Homer *	1872	May 3, 1880
Le Conte, John *	1878	Apr. 29, 1891
Le Conte, John L.*		Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carey *	1892	Mar. 15, 1897
Leidy, Joseph		Apr. 30, 1891
Lesley, J. Peter		June 3, 1903
Lesquereux, Leo *	1864	Oct. 25, 1889
Longstreth, Miers F		Dec. 27, 1891
Loomis, Elias *	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore *	1872	Sept. 10, 1897
Mahan D. H.*		Sept. 16, 1871
Marsh, G. P.*	1866	July 23, 1882
Marsh, O. C	1874	Mar. 18, 1899
Mayer, Alfred M	1872	July 13, 1897
Mayo-Smith, Richmond	1890	Nov. 11, 1901
Meek, F. B.*	1869	Dec. 21, 1877
Meigs, M. C.*	1865	Jan. 2, 1892
Mitchell, Henry	1885	Dec. 1, 1902
Morgan, Lewis H.*	1875	Dec. 14, 1881
Morton, Henry	1871	May 9, 1902
Newberry, J. S.*		Dec. 7, 1892
Newton, H. A.*		Aug. 1, 1896
Newton, John *	1876	May 1, 1895
Norton, William A.*	1873	Sept. 21, 1883
Oliver, James E.*	1872	Mar. 27, 1895
Packard, A. S	1872	Feb. 14, 1905
Peters, C. H. F	1876	July 18, 1890
Pourtales, L. F.*	1873	July 19, 1880
Powell, John W	1880	Sept. 23, 1902
Rodgers, John		May 5, 1882
Rogers, Fairman		Aug. 23, 1900
Rogers, Robert E.*		Sept. 7, 1884
Rogers, Wm. A.*	1885	Mar. 1, 1898
Rogers, William B.*		May 30, 1882
Rood, Ogden N	1885	Nov. 12, 1902
Rowland, Henry A.*	1881	Apr. 16, 1901
Rutherfurd, Lewis M *		May 30, 1892
Saxton, Joseph *		Oct. 26, 1873
Schott, Charles A	1872	July 31, 1901
Sellers, William	1873	Jan. 24, 1905
Silliman, Benj., Sr.*		Nov. 24, 1864
Silliman, Benj., Jr.		Jan. 14, 1885
Smith, J. Lawrence*	1872	Oct. 12, 1883
Stimpson, William *	1868	May 26, 1873
Strong, Theodore *		Feb. 1, 1869
Sullivant, W. S.*	1873	Apr. 30, 1882
Torrey, John*		Mar. 10, 1873
Totten, J. G.*		Apr. 22, 1864
Trowbridge, William P.*	1872	Aug. 12, 1892
Trumbull, James H	1872	Aug. 5, 1897
Tuckerman, Edward*	1868	Mar. 15, 1886
Walker, Francis A.*	1878	Jan. 5, 1897

*Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death.
Warren, G. K.*	1876	Aug. 8, 1882
Watson, James C.*	1868	Nov. 23, 1880
Watson, Sereno*	1889	Mar. 9, 1892
Winlock, Joseph*		June 11, 1875
Woodward, J. J.*	1873	Aug. 17, 1884
Worthen, A. H.*	1872	May 6, 1888
Wyman, Jeffries*		Sept. 4, 1874

* Biographical notices have been presented of those designated by an asterisk.

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst Von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.
C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.
Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekulé.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.
Henri de Lacaze-Duthiers.
Alfred Cornu.
Rudolph von Virchow.
Sir George G. Stokes.
Karl Gegenbaur.
Karl Alfred Ritter von Zittel.
E. J. Marey.
Otto von Struve.
F. von Richthofen.
Albert von Kölliker.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1906

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1906

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE YEAR 1906.

NATIONAL ACADEMY OF SCIENCES,
OFFICE OF THE PRESIDENT,
Washington, D. C., January 2, 1907.

SIR: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

ALEXANDER AGASSIZ.

The PRESIDENT OF THE SENATE.

ACT OF INCORPORATION AND AMENDMENTS.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherfurd, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and regulations; to fill all vacancies created by death, resignation, or

otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882.*

True copies.

SEVELLON A. BROWN, *Chief Clerk.*

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN, *Chief Clerk.*

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1906 the academy held three sessions. The first was the regular annual session, held at Washington April 16 to 18, inclusive; the second, a scientific session held at Boston November 20 to 22; the third, a special session held at Boston November 20 and 21 for the transaction of business.

ANNUAL MEETING.

The council met at the residence of the home secretary, 1724 I street NW., Washington, D. C., Tuesday morning, April 16, with the president, Mr. Alexander Agassiz, in the chair. The remainder of the session was held at the United States National Museum.

The following members were present during the session: Messrs. Abbot, Agassiz, Becker, Billings, Boss, Brewer, Brush, Campbell, Cattell, Chittenden, Crafts, Dall, Dutton, Emmons, Gill, Hague, Hale, Holmes, Howell, Merriam, Morley, Morse, Newcomb, Noyes, Osborn, Peirce, Pupin, Remsen, Trelease, Walcott, Webster, Welch, Wells, and Woodward.

REPORT OF THE HOME SECRETARY.

The President of the National Academy of Sciences.

Sir: I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 16, 1906.

The annual report of the president of the academy was transmitted to Congress January 14, 1906, through the courtesy of Senator Wetmore, chairman of the Committee on the Library. The edition of 500 copies was received from the Government Printing Office February 23. Nearly one-half of the edition has been distributed to the members of the academy, foreign associates, and such libraries as are on our domestic exchange list.

Since the last annual meeting Part II of Dr. A. S. Packard's "Monograph on Bombycine moths" has been issued as volume IX of the Memoirs of the Academy. The entire edition was received from the Government Printing Office October 26, 1905. About one-half the entire edition has been distributed. Three hundred and twenty-four copies were sent to those on the foreign and domestic exchange list, and the others to the members of the academy, foreign associates, and to special investigators in entomological work.

Memoirs 1, 2, and 3 of Volume X have been received—No. 1, entitled "The absolute value of the acceleration of gravity determined by the ring-pendulum method," by Charles E. Mendenhall; No. 2, entitled "Claytonia gronov," by Theodore Holm; No. 3, entitled "A research upon the action of alcohol upon the circulation," by Horatio C. Wood and Daniel M. Hoyt. Copies of each have been sent to members and foreign associates of the academy and such other persons named in the list furnished by the respective authors of these memoirs. One-half of the edition is still held at the Government Printing Office for binding when the volume is completed.

Memoir 4, Volume X, entitled "Phoronis Architecta," by W. K. Brooks and R. P. Cowles, is now in press and will soon be issued.

Memoir 5, entitled "On a new Pyrosoma," by W. K. Brooks, was transmitted to the Public Printer April 10.

The only biographical memoir published during the year appeared as No. 1 of Volume VI of the Biographical Memoirs of the Academy. It is a biography of Dr. J. S. Newberry by Dr. C. A. White.

Messrs. John C. Branner, William H. Holmes, Wiliam H. Howell, Arthur A. Noyes, and Michael I. Pupin were elected members of the Academy at the annual meeting in April, 1905. One member, Mr. S. P. Langley, died during the past year. To-day there are 95 names on the active membership list and 40 foreign associates.

Very respectfully,

ARNOLD HAGUE,
Home Secretary.

APRIL 17, 1906.

REPORT OF THE TREASURER.

WASHINGTON, D. C., *April 18, 1906.*

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 16, 1906:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.	Gould fund.	Emmons and Gill, trustees.	Building fund.
Balance brought forward:								
Cash	$443.31	$766.37	$119.97	$71.24	$612.79	$765.94	$403.80	$199.29
Invested income	3,900.00	3,000.00	3,293.71	....	1,746.57	1,000.00	....	1,500.00
Interest	496.70	2,222.14	1,113.09	390.46	368.81	895.00	....	67.50
Members' tax	480.00	....	....	....	....	....	....	....
Bureau of Insular Affairs.	198.60	....	....	....	....	....	....	....
Total	5,118.61	5,988.51	4,526.77	461.70	2,728.17	2,660.94	403.80	1,766.79
Disbursed	330.92	1,620.98	3,228.25	264.52	120.83	632.01	86.85	1.33
Transfer to capital fund.	....	....	....	134.84	....	....	....	1,500.00
Balance:								
Cash	287.69	2,367.53	1,142.58	62.34	591.91	1,028.93	316.95	265.46
Invested income	4,500.00	2,000.00	155.94	....	2,015.43	1,000.00	....	....
Total	5,118.61	5,988.51	4,526.77	461.70	2,728.17	2,660.94	403.80	1,766.79

Very respectfully,

S. F. EMMONS, *Treasurer.*

The treasurer's report was referred to an auditing committee consisting of Messrs. Gill and Dall, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer.

THEO. N. GILL.
WM. H. DALL.

REPORT OF TRUST FUNDS.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND FOR 1905–1906.

The board of directors of the Bache fund herewith present, as a matter of courtesy to the Academy, the following statement:

Since the last stated meeting of the Academy, April, 1905, the directors have made the following appropriations:

1905.		
Sept. 18.	To Dr. H. C. Wood, for a study of the vaso-motor system of the lungs, with especial regard to the location of their centers and of the effects of drugs upon them	$300
Oct. 7.	To Dr. Theodore Lyman, for a study of spectra of gases and metals in Schumann's short wave-length region	300
Nov. 27.	For the establishment of an American table in the laboratory at the Col d'Olen on Monte Rosa, in cooperation with the Elizabeth Thompson fund, which contributes a like amount	500
Dec. 5.	To Prof. Duncan S. Johnson, for researches on the development and ecology of the Piperaceæ and Chloranthaceæ of Jamaica, etc	400

Respectfully submitted.

S. C. Chandler.
H. P. Bowditch.
Ira Remsen.

REPORT OF THE DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND FOR THE ACADEMY YEAR 1905–6.

The directors of the Benjamin Apthorp Gould fund present the following report:

Since the last stated meeting of the Academy, April, 1905, the following appropriation has been made:

1906.		
Mar. 6.	To Charles L. Doolittle, in continuation of his investigation with reflex zenith tube and zenith telescope, appropriations for which have already been reported in 1901 and 1905; present additional appropriation	$500

Several applications which will doubtless receive favorable action are pending, but are not in shape for formal report at this time.

Lewis Boss.
Seth C. Chandler.

THE J. LAWRENCE SMITH FUND.

The trustees submit the following report:

In accordance with a request recently received from Professor Brush, I beg to submit the following report of work which I have done under the grant made me by the trustees of the J. Lawrence Smith fund:

By consent of the committee, granted March 14, 1905, the scope of the catalogue which I am preparing has been limited to the meteorites of North America. This involves the description of 235 falls, the number at present recognized from this area. The account of these in bulk I have practically completed, the copy reaching a total of 860 typewritten pages. This gives a comprehensive account of each separate fall and a study of its characters as reported in all published literature, together with a bibliography. There remains to me the task of condensing and connecting these various accounts into a systematized and readable whole and the statement of conclusions from the study. This work I am pushing as rapidly as possible.

I have also prepared maps as originally planned, showing the location and character of each fall. These are now complete and ready for publication, the total number being 36. The publication of these alone at the present time might serve a useful purpose, but on the whole it seems to me better to hold them until the publication of the catalogue.

Of the amount granted me there still remains unexpended $90, all of which will doubtless be needed in the completion of the work.

Yours respectfully,

OLIVER C. FARRINGTON.

REPORT OF THE COMMITTEE ON SOLAR RESEARCH.

As stated in previous reports, a preliminary conference on coopertion in solar research was held, at the suggestion of this committee, in connection with the Congress of Arts and Science, at St. Louis, in September, 1904, where arrangements were made for the establishment of a permanent organization and for a second conference, which was held at New College, Oxford, September 27–29, 1905.

At the Oxford Conference the National Academy was represented by Messrs. Campbell and Hale. The following academies and societies also sent official representatives: International Association of Academies, Royal Society of London, Stockholm Academy of Sciences, St. Petersburg Academy of Sciences, Astronomical and Astrophysical Society of America, Royal Astronomical Society, Astronomical Society of France, Physical Society of France, Paris Academy of Sciences, American Physical Society, Amsterdam Academy of Sciences, German Physical Society, Solar Commission of International Meteorological Committee, Madrid Geographical Institute. Various observatories, not directly represented by societies, also sent delegates.

The following programme was carried out:

Wednesday, September 27.

10 a. m.:
1. Introductory proceedings.
2. Election of officers for the meeting.
3. Approval of programme.

10.45 a. m.:
4. Discussion on standards of wave length.
5. Discussion of cooperation in spectroheliograph work, including related spectroscopic investigations.

1 p. m.: Discussion of the Constitution of the Union.

Thursday, September 28.

10 a. m.:
1. Discussion of cooperation in measurements of the intensity of solar radiation.
2. Discussion of the spectroscopic determination of solar rotation.
3. Discussion of other matters brought forward by delegates.

Friday, September 29.

10 a. m.:
1. Place and date of next meeting.
2. Election of officers.
3. Appointment of committees.
4. Formal resolutions.

1 p. m.: Adjournment of the conference.

After a discussion on new standards of wave lengths, introduced by Professor Kayser, the following resolutions were adopted:

1. The wave length of a suitable spectroscopic line shall be taken as the primary standard of wave length. The wave length of this line shall be fixed permanently, and thereby define the unit in which all wave lengths are to be measured. This unit shall differ as little as possible from 10^{10} meters, and be called the *Angström*.

2. Secondary standards are required at distances which should not be greater than 50 Angström units apart. These secondary standards should be referred to the primary standard by means of an interferometer method. The source of light should be obtained by means of an electric arc of from 6 to 10 ampères.

3. A committee shall be appointed to select the standards and to organize the determination of their wave lengths in terms of the primary standard in at least two independent laboratories.

4. The same committee shall be charged with the selection of tertiary standards which shall be at distances of from 5 to 10 A. The wave lengths of these tertiary standards are to be obtained by interpolation with the help of gratings.

A discussion on cooperation in work with the spectroheliograph, including related spectroscopic investigations, was opened by Professor Hale. The following resolutions were subsequently adopted:

1. Cooperation is desirable in the various branches of solar research, such as visual and photographic observations of the solar surface, visual observations of prominences, and observations of the solar atmosphere with spectroheliographs of various types.

2. When an institution has collected and coordinated results from various sources, members of the union shall be requested to place their observations at the disposal of the said institution.

3. In the case of investigations which have not yet been thus collected and coordinated, special committees nominated by the union shall be charged with the work of collection and coordination. The committees will be requested to communicate the scheme and proposals to the executive committee, with a view of initiating a system of observations according to the scheme.

4. It is proposed forthwith to organize through the union such cooperation in two branches of research:

(a) The study of the spectra of sun spots.

(b) The study of the records, by means of the H and K light, of phenomena of the solar atmosphere.

5. The union lays special stress on the fact that, notwithstanding the obvious utility of cooperation in certain cases, individual initiative is the chief factor in a very large number. It is as much the duty of the union to encourage original researches as to promote cooperation.

The International Union for Cooperation in Solar Research was permanently established, and articles of the constitution of the union, suggested by the executive committee, were adopted with various amendments.

Professor Angström opened the discussion on cooperation in measurements of solar radiation. The following resolutions, proposed by Professor Schuster, were adopted:

1. In order to secure uniformity it is desirable that observations on the intensity of solar radiation in different localities shall be made as far as possible with the same type of instrument.

2. That for the present Angström's pyrheliometer be adopted as the standard instrument.

3. That it is desirable to obtain accurate comparisons between the records of Angström's pyrheliometer and other standard instruments, and that Mr. Abbot, Professor Callendar, Prof. Wladimir Michelson, and Mr. W. E. Wilson be asked to assist the union in this work.

4. That for the determination of the possible changes in the solar radiation power it is desirable to secure measurements of the intensity over limited ranges of the spectrum, which are not affected by absorption due to ozone, aqueous vapor, and carbonic acid.

5. That a committee be appointed to draw up a scheme of cooperation and proposals for the reduction of observations. That the committee be requested to communicate the scheme and proposals to the executive committee, with a view to initiating a system of observations according to the scheme.

6. That the union recognizes the great importance of measurements of the relative intensities of radiation, by direct photographs as well as by other methods, emitted by different parts of the solar surface, and desires to include such measurements in the subjects to be dealt with by the union.

A discussion on the spectroscopic determination of the solar rotation was opened by Professor Campbell, and the following resolution was adopted:

The union recognizes the importance of investigating the problem of solar rotation by spectroscopic methods, and desires to include this subject among those to be dealt with by the union.

The following additional resolutions were also adopted:

That the union request the International Association of Academies to allow itself to be placed at the head of the list of bodies constituting the union.

That the International Association of Academies be asked to agree to nominate one of the three members of the executive committee. The union suggests that the nomination of this member may conveniently be made by the leading academy, the nomination holding while the academy continues to act as leading academy.

That in the opinion of the Conference it would be desirable that countries which do not contain scientific bodies forming part of the union should organize solar research by forming committees which could cooperate with the union.

It was decided that the next meeting of the union be held at the Astrophysical Observatory of Meudon (near Paris), in September, 1907.

The executive committee of the union was constituted by the appointment of Professors Schuster (chairman), and Hale, with the understanding that the International Association of Academies would be requested to appoint the third member. The central bureau of the union is to be at the physical laboratory of the University of Manchester, under the direction of Professor Schuster, and the computing bureau of the union is to be at the University of Oxford, under the direction of Professor Turner.

The following committees were appointed:

(a) Committee on standards of wave length: Professor Kayser (chairman), Professor Ames, M. Fabry, Professor Michelson, and M. Pérot.

(b) Committee on solar radiation: Professor Angström (chairman), Mr. Abbot, Professor Callendar, Doctor Julius, Professor Schuster, and M. Violle.

(c) Committee on cooperation in work with the spectroheliograph: Professor Hale (chairman), M. Deslandres, Professor Frost, Dr. W. J. Lockyer, Professor Riccò, and Mr. Michie Smith.

(d) Committee on spectra of sun spots: Professor C. A. Young (chairman), Professor Bélopolsky, Sir W. H. M. Christie, Fr. Cortie, M. Deslandres, Mr. Fowler, Sir N. Lockyer, Mr. Newall, and Doctor Wolfer.

Full proceedings of the meeting, including the articles of constitution of the union and the various papers communicated, will be published in the Transactions of the International Union for Cooperation in Solar Research, a copy of which will be transmitted to the academy.

The admirable arrangements made for the meeting by Professor Turner and the cordial hospitality shown by New College, where all the delegates were entertained, and subsequently by the University of Cambridge, which the members of the union visited in a body, combined to render the Conference a very successful one.

Respectfully submitted.

George E. Hale, *Chairman.*

ELECTIONS.

ELECTION OF OFFICERS.

Messrs. Billings, Chittenden, Hale, Osborn, Welch, and Woodward were elected members of the council.

ELECTION OF NEW MEMBERS.

Messrs. Benjamin O. Peirce, William B. Scott, and Josiah Royce were elected members of the Academy.

ELECTION OF FOREIGN ASSOCIATES.

Wilhelm Ostwald, of Leipzig, and Hendrik Anton Lorentz, of Leiden, were elected foreign associates of the Academy.

DEATH

Two members of the Academy died during the year 1906; Samuel P. Langley February 27, and Samuel L. Penfield August 13.

Ludwig Boltzmann, of Vienna, a foreign associate, died September 6.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

The Distribution of American Men of Science, J. McK. Cattell.

Recent Developments of Existential Graphs and their Consequences for Logic, C. S. Peirce.

Commelinaceæ. Morphological and Anatomical Studies of the Vegetative Organs of Some North and Central American Species, Theo. Holm. (Presented by Theo. Gill.)

On the Classification of the Cidaridæ, A. Agassiz and H. L. Clark.

Interference of Oviposition of a Sargasso Fish with a Flying Fish, Theo. Gill.

Faunal and Geological Succession in Eocene and Oligocene Basins of Rocky Mountain Region, H. F. Osborn.

Volcanic Ash in the Bridger Beds of Wyoming, W. J. Sinclair. (Presented by H. F. Osborn.)

Radio-Activity and Volcanoes, C. E. Dutton.

Cambrian Faunas of China, C. D. Walcott.

Recent Solar Investigations, George E. Hale.

Some Recent Solar Eclipse Results, W. W. Campbell and C. D. Perrine.

Feeble, Rapidly Alternating, Magnetization of Iron, M. I. Pupin.

Primary Standards for Temperature Measurements between 100° and 350°, J. M. Crafts.

Biographical Memoir of Admiral John Rodgers, Asaph Hall.

Biographical Memoir of George P. Marsh, W. M. Davis.

The Life History of Pterophryne, Theo. Gill.

ANNOUNCEMENTS.

The president announced that Mr. E. S. Dana had been appointed a member of the committee on the J. Lawrence Smith fund in place of Mr. George J. Brush, resigned, and Mr. Edward W. Morley was named as chairman of the committee.

He also announced the appointment of Mr. Henry F. Osborn as a member of the committee on the election of foreign associates.

The president announced that Mr. Arnold Hague had been appoined to represent the Academy at the quaternary celebration of the University of Aberdeen, Scotland.

AUTUMN MEETING OF THE ACADEMY.

SCIENTIFIC SESSION.

[Held in Boston, November 20 to 22, 1906.]

A scientific session for the reading of papers having been called by the council, the academy met in the new buildings of the Harvard Medical School, Longwood avenue, Boston, November 20, 21, and 22, 1906.

President Agassiz presided at the sessions and the following members were in attendance: Messrs. Barker, Barus, Bell, Billings, Boas, Brewer, Brush, Cattell, Chandler (C. F.), Chandler (S. C.), Chittenden, Comstock (George C.), Councilman, Crafts, Davis, Emmons, Farlow, Gooch, Goodale, Hague, Hale, Mark, Michael, Minot, Morley, Morse, Newcomb, Nichols, Noyes, Osborn, Peirce (C. S.), Pickering, Remsen, Richards, Scott, Trowbridge, Van Hise, Walcott, Webster, Welch, Wells, Woodward.

The following papers were presented:

A Few Notes Concerning Progress in Experiments Relating to Aerodromics. Alexander Graham Bell.

A Method for the Enumeration of Algebraic Invariants. William E. Story. (Introduced by A. G. Webster.)

Acoustic Measurements. Arthur G. Webster.

Vasomotor Relations. W. T. Porter. (Introduced by H. P. Bowditch.)

The Conductivity, Ionization, and Hydrolysis of Salts in Aqueous Solution at High Temperatures. Arthur A. Noyes.

Theory and Application of the Double Suspension Pendulum. R. S. Woodward.

The Minimal Proteid Requirement of High Proteid Animals. Russell H. Chittenden.

The Free Energy of Oxidation Processes. Gilbert N. Lewis. (Introduced by A. A. Noyes.)

Wave-Length Measurements in Wireless Telegraphy. George W. Pierce. (Introduced by John Trowbridge.)

Measurement of the Thomson Thermoelectric Effect in Metals. Edwin H. Hall. (Introduced by John Trowbridge.)

Analogy between Electrical Energy and Nervous Energy. John Trowbridge.

Continental Sedimentation, with Applications to Geological Climates and Geography. Joseph Barrell. (Introduced by W. M. Davis.)

Light of Extremely Short Wave Length. Theodore Lyman. (Introduced by John Trowbridge.)

The Eastern Slope of the Mexican Plateau. W. M. Davis.

Evidence of Desiccation during Historic Times Discovered in Chinese Turkestan in 1905–6. Ellsworth Huntington. (Introduced by W. M. Davis.)

Planetary Inversion and the Tenth Satellite of Saturn. William H. Pickering. (Introduced by E. C. Pickering.)

The Work of the Bruce Telescope. S. I. Bailey. (Introduced by E. C. Pickering.)

The Heat of Combustion of Benzol. Theodore W. Richards, L. J. Henderson, and H. L. Fevert.

The Atomic Weights of Nitrogen and Silver. Theodore W. Richards and George S. Forbes.

Structure of Richthofenia. Robert T. Jackson. (Introduced by E. L. Mark.)

On the Process of Fixing Characters in Animal Breeding. W. E. Castle. (Introduced by E. L. Mark.)

The Maturation of the Mammalian Ovum. E. L. Mark and J. A. Long.

The Marine Biological Station at La Jolla, Cal. E. L. Mark.

Reactions of Amphioxus to Light. G. H. Parker. (Introduced by E. L. Mark.)

The Absorption Spectra of Solutions in Relation to the Present Hydrate Theory. H. C. Jones. (Introduced by Ira Remsen.)

On the Salts of Tautomeric Compounds. S. F. Acree. (Introduced by Ira Remsen.)

The Temples of the Cross, of the Foliated Cross, and of the Sun, at Palenque, Mexico. Charles P. Bowditch. (Introduced by F. W. Putnam.)

Extent and Structure of the Stellar System. George C. Comstock.

Tyrannosaurus. Upper Cretaceous Carnivorous Dinosaur. Henry F. Osborn.

Section of American Tertiaries. Henry F. Osborn.

Complete Mounted Skeleton of Fin-Back Lizard Neosaurus of the Peruvian. Henry F. Osborn.

Metabolism of Creatin and Creatinin. Otto Folin. (Introduced by H. P. Bowditch.)

Nature and Cause of Old Age. Charles S. Minot.

Phaneroscopy, or Natural History of Signs, Relations, Categories, etc.: A method of investigating this subject expounded and illustrated. C. S. Peirce.

Heterogeneous Elements of the Continent as Factors in the History of North America. Bailey Willis. (Introduced by Charles D. Walcott.)

Present State of Knowledge as to Motions of the Terrestrial Pole. S. C. Chandler.

The Origin of the Ores of the Cobalt-Silver District of Ontario. Charles S. Van Hise.

Geological and Biological Study of the Cambrian Brachiopods. Charles D. Walcott.

The Catalysis of Sulphuric Acids. J. M. Crafts.

The Miocene Mammals of Patagonia. W. B. Scott.

Sun-Spot Spectra and their Bearing on Stellar Evolution. George E. Hale.

A Few Notes of Progress in the Construction of an Aerodrome with a Historical Introduction. Alexander Graham Bell.

The Use of the Statistical Method in the Systematic Study of Bacteria. Charles E. A. Winslow. (Introduced by A. A. Noyes.)

Biographical Memoir of Fairman Rogers. Edgar F. Smith.

BUSINESS MEETING.

[Boston, November 20 and 21, 1906.]

REPORT OF THE COMMITTEE ON COOPERATIVE RESEARCH IN CHEMISTRY.

The committee to which has been referred the plan of cooperative research in chemistry relating to the study of the equilibrum of chemical reactions, which plan was submitted to the Academy at its last meeting, offers the following report of progress:

The committee has taken under consideration the various aspects of the plan proposed, and has decided to express to the Academy its approval of the main features of it, and to recommend that the development of the plan be proceeded with. The committee is convinced that the line of investigation contemplated by the proposal is one of the broadest and most important fields of experimental research in chemistry now opened for cultivation, and that it is one which lends itself in an unusual degree to cooperation on the part of many investigators, even of those who may not possess unusual facilities or the highest experimental skill. Even though it should not prove practicable to secure a large measure of cooperation and though it should happen that no large addition to science directly result, yet the committee believes that the definite formulation and publication by the Academy of a systematic plan of research in this new field would, of itself alone, be a valuable contribution to the advancement of the subject, by drawing the attention of investigators in general to it and by bringing before them in a definite way the present fragmentary state of our knowledge of it and the directions in which that knowledge can be most effectively extended.

With respect to the ultimate securing of cooperation in the execution of the work, the committee recognizes the fact that this is of the nature of an experiment; but it believes that it is one well worth entering upon; for if even moderately successful, it would result, in the opinion of the committee, in a general stimulation of the research spirit in our institutions, and especially among the younger generation of chemists. In this connection, it may be mentioned that one of the methods of securing cooperation which the committee has considered as most likely to be effective would be to address, after the plan had been fully formulated, personal letters to those in charge of the chemical departments of various institutions, asking whether there were not members of their staffs who would like to participate in this general plan of research indorsed by the Academy by taking up the investigation of some special problem connected with it.

The committee therefore asks to be informed whether, in view of these considerations, it is desired that the committee prepare a more definite statement of the general considerations underlying the proposed subject of investigation, the present state of knowledge in regard to it, and an outline of a systematic plan to further research, with the understanding that this more developed plan be submitted to the Academy for its approval before proceeding to its publication or to the securing of cooperation in its execution. If this should be desired by the Academy, the committee respectfully asks that it be permitted, in the preparation and execution of the plan, to secure the assistance of Dr. G. N. Lewis, an investigator who has devoted himself successfully to work in this special direction, and that there be placed at the disposal of the committee the funds which have been generously offered to the Academy for this purpose by the trustees of the William E. Hale research fund.

ARTHUR A. NOYES.
EDWARD W. MORLEY.
THEODORE WM. RICHARDS.

The report was approved and the committee instructed to take further steps to carry out its suggestions.

The original proposal, which was made to the Academy during the April session, is as follows:

COOPERATIVE RESEARCH IN CHEMISTRY.

The principle of the second law of energetics that any change in the state of a system, whether physical or chemical, is capable of producing under the most favorable conditions a definite quality of work is one whose importance has been extensively recognized within the last few years. This importance arises not only from the direct significance from a scientific and technical standpoint of this maximum quantity of work obtainable from any physical change or chemical reaction, but also from the fact that from its value alone can be directly computed the equilibrium conditions of the chemical reaction in question, the direction in which under specified conditions it will take place, and the electromotive force of any voltaic cell in which the reaction goes on reversibly. The hopes of the earlier thermochemists that the heat effect attending chemical reactions would enable us to predict the direction of the occurrence and their equilibrium have been shown both empirically and by the energy principles to be unfounded; but in this work quantity we have a reliable means of making such predictions and in it therefore a satisfactory measure of the hitherto indefinite conception of chemical affinity.

In spite of its great importance our present knowledge of the values of this maximum work in the case of specific chemical reactions is extreemly limited and fragmentary. This condition has arisen not only from the fact that its significance has only recently been recognized, but also from the difficulties inherent in the experimental determination of its numerical values; for no general method is available similar to that used for determining heat effects by thermochemical measurements, but for each specific reaction a suitable method must be devised and worked out. Such methods, as far as our present knowledge goes, must be based on one of two principles—either upon the measurement of the electromotive force of some cell in which the reaction in question, and that alone, takes place, or on a determination of its equilibrium by chemical means—and in either case the study of a single reaction may constitute a small research.

For this reason the general solution of the problem with a completeness comparable to that already attained in the case of thermochemical data involves a vast amount of experimental investigation, and can be accomplished only very slowly unless the effort of many workers is concentrated upon it in a systematic way. This problem—one of the most important purely experimental ones of the chemistry of to-day—seems, therefore, to be one especially adapted to cooperative research, and one which the Academy could greatly promote by laying out a comprehensive plan of attack and using its influence to induce individual investigators to take up portions of the work. It has from this point of view the great advantage that the work would not consist of routine measurements made by a general method, but would offer to each researcher an abundant opportunity for the exercise of experimental ingenuity. Moreover, the percentage accuracy attainable and required would not be the highest, so that even those investigators who might not have great experience or the best facilities could participate in the work. And there would seem to be reason to hope from such a plan not only that the direct additions to scientific knowledge would be considerable, but that the spirit of research would be stimulated among chemists, especially the younger ones, throughout the country.

The president announced that Mr. George Hale, on behalf of the trustees of the William E. Hale fund, had offered to the Academy the sum of $300, to be used in carrying out the objects of the committee on cooperation in chemical research, and that the gift had been accepted.

Announcement was also made that Mr. George F. Barker, on behalf of the Academy, had been appointed a delegate to attend the dedication of the new engineering building of the University of Pennsylvania on the 19th of October, 1906.

APPENDICES.

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APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six

years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

SEC. 2. The officers of the Academy, together with six members to be elected by the Academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

SEC. 3. The president of the Academy, or in case of his absence or inability to act the vice-president, shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the first stated session in each year.

SEC. 4. Nominations of members may be made in writing, signed by any five members of the Academy, at any stated session, to be voted on at the next stated session held in Washington, and each nomination shall, at the time of election, be accompanied by a written list of the original works of the nominee.

SEC. 5. The Academy shall be divided into six standing committees. In this classification a member who is eminent in more than one subject may be assigned to a corresponding number of committees. The classification shall be the following:

1. Mathematics and astronomy.
2. Physics and engineering.
3. Chemistry.
4. Geology and paleontology.
5. Biology.
6. Anthropology.

In nominating for membership in the Academy, a statement must be made as to the subject or subjects in which the person nominated is eminent. Every nomination must be submitted, through the secretary, to all the members of the committee or committees representing the subject or subjects in which the person nominated is stated to be eminent; and in order that his name may be brought before the Academy for election he must receive the votes of a majority of the members of the committee or committees to which his name has been referred.

Elections for membership shall be held in the following manner: Each member may inscribe on a ballot not more than five names of nominees selected from the list. Absent members may send such ballots to the home secretary. From the seven names receiving the highest number of votes in this preference ballot the members present may proceed to elect new members in the following manner: A vote shall first be taken on the nominee who received most votes on the preference ballot, and he shall be declared elected if he receive two-thirds of the votes cast and not less than twenty votes in all, provided that the number of members of the Academy be not one hundred or over, in which case, to be declared elected, he must receive four-fifths of the votes cast and not less than twenty-five votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until the seven nominees on the preference list shall have been acted on or until five nominees shall have been elected.

Should several nominees have the same minimum number of votes on the preference list, the requisite number for completing the list shall be selected from them by a two-thirds vote of the members present. Should several names within the preference list have the same number of votes, their order on the list may be determined by a majority vote of the members present.

Election of members shall be held only at the regular stated session of each year held in Washington, and not more than five members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

Sec. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

Sec. 7. Foreign associates may be nominated by a committee of five members, to be appointed for that purpose by the president and elected at any stated session by a two-thirds vote of the members present. The election shall be had by each member indicating on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the ballots shall be declared elected.

SEC. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the Academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

SEC. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the Academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

SEC. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.

6. Business from council.

7. Other business.

8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of Departments of the Government, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1906-7.

	Expiration of term.
Agassiz, Alexander, *President*	April, 1907.
Remsen, Ira, *Vice-President*	April, 1909.
Newcomb, Simon, *Foreign Secretary*	April, 1909.
Hague, Arnold, *Home Secretary*	April, 1907.
Emmons, S. F., *Treasurer*	April, 1908.

ADDITIONAL MEMBERS OF COUNCIL, 1906-7.

Billings, J. S.
Chittenden, R. H.
Hale, George E.
Osborn, H. F.
Welch, W. H.
Woodward, R. S.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
    - Abbe, C.
    - Boss, Lewis.
    - Campbell, W. W.
    - Chandler, S. C.
    - Comstock, G. C.
    - Davidson, G.
    - Elkin, W. L.
    - Hale, G. E.
    - Hall, A.
    - Hill, G. W.
    - Holden, E. S.
    - Moore, E. H.
    - Newcomb, S.
    - Osgood, W. F.
    - Peirce, C. S.
    - Pickering, E. C.
    - Webster, A. G.
    - Woodward, R. S.
    - Young, C. A.
2. Physics and Engineering.
    - Abbe, C.
    - Abbot, H. L.
    - Barker, G. F.
    - Barus, C.

2. Physics and Engineering—Cont'd.
    - Bell, A. G.
    - Comstock, C. B.
    - Hastings, C. S.
    - Mendenhall, T. C.
    - Michelson, A. A.
    - Morley, E. W.
    - Nichols, E. L.
    - Noyes, A. A.
    - Peirce, B. O.
    - Pickering, E. C.
    - Pupin, M. I.
    - Trowbridge, J.
    - Webster, A. G.
    - Woodward, R. S.
    - Wright, A. W.
3. Chemistry.
    - Barker, G. F.
    - Brush, G. J.
    - Chandler, C. F.
    - Chittenden, R. H.
    - Crafts, J. M.
    - Dana, E. S.
    - Gibbs, W.
    - Gooch, F. A.

3. Chemistry—Continued.
    - Hilgard, E. W.
    - Jackson, C. L.
    - Johnson, S. W.
    - Michael, A.
    - Morley, E. W.
    - Nef, John U.
    - Noyes, A. A.
    - Remsen, Ira.
    - Richards, T. W.
    - Smith, E. F.
    - Wells, H. L.
4. Geology and Paleontology.
    - Agassiz, A.
    - Becker, G. F.
    - Branner, J. C.
    - Chamberlin, T. C.
    - Dall, W. H.
    - Davis, W. M.
    - Dutton, C. E.
    - Emmons, S. F.
    - Gilbert, G. K.
    - Hague, Arnold.
    - Osborn, H. F.
    - Pumpelly, R.
    - Scott, W. B.
    - Van Hise, C. R.
    - Walcott, C. D.
    - White, C. A.
5. Biology.
    - Agassiz, A.
    - Allen, J. A.
    - Bowditch, H. P.
    - Brewer, W. H.
    - Brooks, W. K.
    - Chittenden, R. H.
    - Councilman, W. T.
    - Dall, W. H.

5. Biology—Continued.
    - Farlow, W. G.
    - Gill, T. N.
    - Goodale, G. L.
    - Howell, W. H.
    - Mark, E. L.
    - Merriam, C. H.
    - Minot, C. S.
    - Morse, E. S.
    - Osborn, H. F.
    - Prudden, T. M.
    - Putnam, F. W.
    - Sargent, C. S.
    - Scudder, S. H.
    - Smith, S. I.
    - Trelease, William.
    - Verrill, A. E.
    - Walcott, C. D.
    - Welch, W. H.
    - White, C. A.
    - Whitman, C. O.
    - Wilson, E. B.
    - Wood, H. C.
6. Anthropology.
    - Billings, J. S. ✓
    - Boas, Franz.
    - Cattell, J. McK. ✓
    - Holmes, W. H. ✓
    - James, Wm. ✓
    - Merriam, C. H. ✓
    - Minot, C. S.
    - Mitchell, S. W. ✓
    - Morse, E. S. ✓
    - Peirce, C. S. ✓
    - Putnam, F. W.
    - Royce, Josiah. ✓
    - Welch, W. H. ✓

On Weights, Measures, and Coinage.

Mendenhall, T. C., *Chairman.* Peirce, C. S.
Michelson, A. A. Comstock, C. B.
Newcomb, S. Young, C. A.
Woodward, R. S.

On the Election of Foreign Associates.

Remsen, Ira, *Chairman.* Mitchell, S. W.
Brush, G. J. Newcomb, S.
Osborn, H. F.

On Publication.

The President. The Home Secretary.
Walcott, C. D.

On Solar Research.

Hale, George E., *Chairman.*
Campbell, W. W.
Michelson, A. A.
Young, C. A.

TRUST FUNDS.

Board of Direction of the Bache Fund.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Chandler, S. C., *Chairman.*
Bowditch, H. P.
Remsen, Ira.

Board of Trustees of the Watson Fund.

[1893, residual estate, $18,666.88.]

For the promotion of astronomical research.

Newcomb, S., *Chairman.*
Elkin, W. L.
Boss, L.

The Henry Draper Fund.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Newcomb, S., *Chairman.*
Hale, G. E.
Trowbridge, John.
Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

[1885, $8,000.]

For the investigation of meteoric bodies.

Morley, E. W., *Chairman.*
Dana, E. S.
Johnson, S. W.
Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

[1897, $20,000.]

For researches in astronomy.

Hall, Asaph, *Chairman.*
Chandler, S. C.
Boss, Lewis.

The Barnard Medal.

Billings, J. S., *Chairman.*
Bowditch, H. P.
Chandler, S. C.
Jackson, C. L.
Newcomb, S.
Nichols, E. L.

The Wolcott Gibbs Fund.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman.*
Remsen, Ira.
Smith, Edgar F.

The Joseph Henry Fund.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others, as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES.
JANUARY 2, 1907.

		Date of election.
Abbe, Cleveland	*2017 I st. NW., Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum, New York City.*	1876
Barker, George F	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Brown University. Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Bowditch, Henry P	*Harvard Medical School, Boston, Mass.*	1887
Branner, John C	*Stanford University, California.*	1905
Brewer, William H	*418 Orange st., New Haven, Conn.*	1880
Brooks, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
Brush, George J	*14 Trumbull st., New Haven, Conn.*	1868
Campbell, William W	*Lick Observatory, Mt. Hamilton, California.*	1902
Cattell, James McK	*Garrison, N. Y.*	1901
Chamberlin, Thomas C	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F	*Columbia University, New York City.*	1874
Chandler, Seth C	*Box 216, Wellesley Hills, Mass.*	1888
Chittenden, Russell H	*Sheffield Scientific School, New Haven, Conn.*	1890
Comstock, Cyrus B., U. S. A	*124 E. Twenty-seventh st., New York City.*	1884
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Councilman, Wm. T	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M	*59 Marlborough st., Boston, Mass.*	1872
Dall, William H	*Smithsonian Institution, Washington, D. C.*	1897
Dana Edward S	*Yale University, New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Davis, William Morris	*17 Francis ave., Cambridge, Mass.*	1904
Dutton, Clarence E., U. S. A	*Englewood, N. J.*	1884
Elkin, William L	*Yale University Observatory, New Haven, Conn.*	1895
Emmons, Samuel F	*U. S. Geological Survey, Washington, D. C.*	1892
Farlow, W. G	*Harvard University, Cambridge, Mass.*	1879
Gibbs, Wolcott	*Newport, R. I.*	——
Gilbert Grove K	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A	*Yale University, New Haven, Conn.*	1897

		Date of election.
Goodale, George L	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E	*Solar Observatory, Mount Wilson, Cal.*	1902
Hall, Asaph	*Norfolk, Conn.*	1875
Hastings, Charles S	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W	*University of California, Berkeley, Cal.*	1872
Hill, George W	*West Nyack, N. Y.*	1874
Holden, Edward S	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H	*Bureau of American Ethnology, Washington, D. C.*	1905
Howell, William H	*232 W. Lanvale st., Baltimore, Md.*	1905
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
James, William	*95 Irving st., Cambridge, Mass.*	1903
Johnson, Samuel W	*54 Trumbull st., New Haven, Conn.*	1866
Mark, Edward L	*109 Irving st., Cambridge, Mass.*	1903
Mendenhall, Thomas C	*Worcester, Mass.*	1887
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H	*University of Chicago, Chicago, Ill.*	1901
Morley Edward W	*West Hartford, Conn.*	1897
Morse, Edward S	*P. O. Box 268, Salem, Mass.*	1876
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Newcomb, Simon, U. S. N	*1620 P st. NW., Washington, D. C.*	1869
Nichols, Edward L	*Cornell University, Ithaca, N. Y.*	1901
Noyes, Arthur A	*Massachusetts Institute of Technology, Boston, Mass.*	1905
Osborn, H. F	*American Museum of Natural History, New York City.*	1900
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Benjamin O	*Harvard University, Cambridge, Mass.*	1906
Peirce, Charles S	*Milford, Pa.*	1876
Pickering, Edward C	*Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*[illegible] Gibbs ave., Newport, R. I.*	1872
Pupin, Michael I	*Columbia University, New York City.*	1905
Putnam, Frederick W	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W	*Harvard University, Cambridge, Mass.*	1899
Royce, Josiah	*Harvard University, Cambridge, Mass.*	1906
Sargent, Charles S	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scott, William B	*Princeton, N. J.*	1906
Scudder, Samuel H	*Cambridge, Mass.*	1877
Smith, Edgar F	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Sidney I	*Yale University, New Haven, Conn.*	1884
Trelease, Wm	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D	*Smithsonian Institution, Washington, D. C.*	1896
Webster, Arthur G	*Clark University, Worcester, Mass.*	1903
Welch, William H	*807 St. Paul st., Baltimore, Md.*	1895
Wells, Horace L	*Yale University, New Haven, Conn.*	1903

		Date of election.
White, Charles A	*1908 13th st. NW., Washington, D. C.*	1889
Whitman, Charles O	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B	*Columbia University, New York City.*	1899
Wood, Horatio C	*1925 Chestnut st., Philadelphia, Pa.*	1879
Woodward, Robert S	*Carnegie Institution, Washington, D. C.*	1896
Wright, Arthur W	*Yale University, New Haven, Conn.*	1881
Young, Charles A	*36 North Main st., Hanover, N. H.*	1872

FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Backlund, Oskar	*Pulkowa.*
Baeyer, Adolph Ritter von	*Munich.*
Becquerel, Henri	*Paris.*
Bornet, Edouard	*Paris.*
Brögger, W. C	*Christiania.*
Darwin, Sir George	*Cambridge.*
Ehrlich, Paul	*Frankfurt-am-Main.*
Fischer, Emil	*Berlin.*
Geikie, Sir Archibald	*London.*
Gill, Sir David	*Cape Town.*
Groth, Paul von	*Munich.*
Hoff, J. H. van't	*Berlin.*
Hooker, Sir J. D	*London.*
Huggins, Sir William	*London.*
Janssen, J	*Paris.*
Kelvin, Lord	*London.*
Klein, Felix	*Göttingen.*
Koch, Robert	*Berlin.*
Kohlrausch, Friedrich	*Marburg.*
Kronecker, Hugo	*Berne.*
Lankester, E. Ray	*London.*
Lister, Lord	*London.*
Loewy, Maurice	*Paris.*
Lorentz, Hendrik Anton	*Leiden.*
Mendeleeff, D. I	*St. Petersburg.*
Ostwald, Wilhelm	*Leipzig.*
Pfeffer, Wilhelm	*Leipzig.*
Picard, Emile	*Paris.*
Poincaré, Henri	*Paris.*
Ramsay, Sir William	*London.*
Rayleigh, Lord	*London.*
Rosenbusch, H	*Heidelberg.*
Strasburger, Edouard	*Bonn.*
Suess, Edouard	*Vienna.*
Thomson, Joseph John	*Cambridge.*
Vogel, H. C	*Berlin.*
Vries, Hugo de	*Amsterdam.*
Zirkel, Ferdinand	*Leipzig.*

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Louis*		Dec. 14, 1873
Alexander, J. H.*		Mar. 2, 1867
Alexander, Stephen*		June 25, 1883
Bache, Alexander Dallas*		Feb. 14, 1867
Baird, Spencer F.*	1864	Aug. 19, 1887
Barnard, F. A. P		Apr. 27, 1889
Barnard, J. G.*		May 14, 1882
Bartlett, W. H. C		Feb. 11, 1893
Beecher, Charles Emerson*	1899	Feb. 14, 1904
Brown-Sequard, Charles E.*	1868	Apr. 2, 1894
Casey, Thomas L.*	1890	Mar. 25, 1896
Caswell, Alexis		Jan. 8, 1887
Chauvenet, William*		Dec. 13, 1870
Clarke, Henry James*	1872	July 1, 1873
Coffin, James*	1869	Jan. 6, 1873
Coffin, J. H. C		Jan. 8, 1890
Cook, George H.*	1887	Sept. 22, 1889
Cooke, Josiah P.*	1872	Sept. 3, 1894
Cope, Edward D.*	1872	Apr. 12, 1897
Coues, Elliott	1877	Dec. 25, 1899
Dalton, J. C.*	1864	Feb. 2, 1889
Dana, James D		Apr. 14, 1895
Davis, Charles H.*		Feb. 14, 1877
Draper, Henry*	1877	Nov. 20, 1882
Draper, John W.*	1877	Jan. 4, 1882
Eads, James B.*	1872	Mar 8, 1887
Engelmann, George*		Feb. 4, 1884
Ferrel, William*	1868	Sept. 18, 1891
Frazer, John Fries*		Oct. 12, 1872
Gabb, William M	1876	May 30, 1878
Genth, F. A.*	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gilliss, James Melville*		Feb. 9, 1865
Goode, G. Brown*	1888	Sept. 6, 1896
Gould, Augustus A.*		Sept. 15, 1866
Gould, Benjamin A		Nov. 27, 1896
Gray, Asa*		Jan. 30, 1888
Guyot, Arnold*		Feb. 8, 1884
Hadley, James*	1864	Aug. 1, 1872
Haldeman, S. S.*	1876	Sept. 20, 1880
Hall, James		Aug. 8, 1898
Hayden, F. V.*	1873	Dec. 22, 1887
Henry, Joseph*		May 13, 1878
Hilgard, Julius E.*		May 8, 1891
Hill, Henry B.*	1883	Apr. 6, 1903
Hitchcock, Edward*		Feb. 27, 1864
Holbrook, J. E.*	1868	Sept. 8, 1871
Hubbard, J. S.*		Aug. 16, 1863
Humphreys, A A.*		Nov. 28, 1883
Hunt, T. Sterry	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Keeler, J. E.*	1900	Aug. 12, 1900
King, Clarence*	1876	Dec. 24, 1901
Kirkland, Jared P.*	1865	Dec. 10, 1877

* Biographical notices have been presented of those designated by an asterisk.

Deceased members—Continued.

	Date of election.	Date of death.
Lane, J. Homer *	1872	May 3, 1880
Langley, Samuel P.	1876	Feb. 27, 1906
Le Conte, John *	1878	Apr. 29, 1891
Le Conte, John L.*		Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carey *	1892	Mar. 15, 1897
Leidy, Joseph.		Apr. 30, 1891
Lesley, J. Peter		June 3, 1903
Lesquereux, Leo *	1864	Oct. 25, 1889
Longstreth, Miers F.		Dec. 27, 1891
Loomis, Elias *	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore*	1872	Sept. 10, 1897
Mahan, D. H.*		Sept. 16, 1871
Marsh, G. P.*	1866	July 23, 1882
Marsh, O. C	1874	Mar. 18, 1899
Mayer, Alfred M	1872	July 13, 1897
Mayo-Smith, Richmond	1890	Nov. 11, 1901
Meek, F. B.*	1869	Dec. 21, 1877
Meigs, M. C.*	1865	Jan. 2, 1892
Mitchell, Henry	1885	Dec. 1, 1902
Morgan, Lewis H	1875	Dec. 14, 1881
Morton, Henry	1874	May 9, 1902
Newberry, J. S.*		Dec. 7, 1892
Newton, H. A.*		Aug. 1, 1896
Newton, John *	1876	May 1, 1895
Norton, William A.*	1873	Sept. 21, 1883
Oliver, James E.*	1872	Mar. 27, 1895
Packard, A. S	1872	Feb. 14, 1905
Penfield, Samuel L.	1900	Aug. 13, 1906
Peters, C. H. F.	1876	July 18, 1890
Pourtales, L. F.*	1873	July 19, 1880
Powell, John W	1880	Sept. 23, 1902
Rodgers, John *		May 5, 1882
Rogers, Fairman *		Aug. 23, 1900
Rogers, Robert E.*		Sept. 7, 1884
Rogers, Wm. A.*	1885	Mar. 1, 1898
Rogers, William B.*		May 30, 1882
Rood, Ogden N	1885	Nov. 12, 1902
Rowland, Henry A.*	1881	Apr. 16, 1901
Rutherfurd, Lewis M.*		May 30, 1892
Saxton, Joseph *		Oct. 26, 1873
Schott, Charles A.	1872	July 31, 1901
Sellers, William	1873	Jan. 24, 1905
Silliman, Benj., Sr.*		Nov. 24, 1864
Silliman, Benj., Jr.		Jan. 14, 1885
Smith, J. Lawrence*	1872	Oct. 12, 1883
Stimpson, William	1868	May 26, 1873
Strong, Theodore*		Feb. 1, 1869
Sullivant, W. S.*	1873	Apr. 30, 1882
Torrey, John *		Mar. 10, 1873
Totten, J. G.*		Apr. 22, 1864
Trowbridge, William P.*	1872	Aug. 12, 1892
Trumbull, James H	1872	Aug. 5, 1897

* Biographical notices have been presented of those designated by an asterisk.

Deceased members—Continued.

	Date of election.	Date of death.
Tuckerman, Edward*	1868	Mar. 15, 1886
Walker, Francis A.*	1878	Jan. 5, 1897
Warren, G. K.*	1876	Aug. 8, 1882
Watson, James C.*	1868	Nov. 23, 1880
Watson, Sereno*	1889	Mar. 9, 1892
Winlock, Joseph*		June 11, 1875
Woodward, J. J.*	1873	Aug. 17, 1884
Worthen, A. H.*	1872	May 6, 1888
Wyman, Jeffries*		Sept. 4, 1874

* Biographical notices have been presented of those designated by an asterisk.

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst Von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.
C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.
Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekulé.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.
Henri de Lacaze-Duthiers.
Alfred Cornu.
Rudolph von Virchow.
Sir George G. Stokes.
Karl Gegenbaur.
Karl Alfred Ritter von Zittel.
E. J. Marey.
Otto von Struve.
F. von Richthofen.
Albert von Kölliker.
Ludwig Boltzmann.
M. P. E. Berthelot.
Henri Moissan.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1907

WASHINGTON
GOVERNMENT PRINTING OFFICE
1908

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LETTER FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES SUBMITTING A REPORT OF THE OPERATIONS OF THE NATIONAL ACADEMY OF SCIENCES FOR THE YEAR 1907.

National Academy of Sciences,
Office of the President,
Washington, D. C., February 1, 1908.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the past year.

Very respectfully,

Ira Remsen.

The President of the Senate.

ACT OF INCORPORATION AND AMENDMENTS.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and regulations; to fill all vacancies created by death, resignation, or

otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

DEPARTMENT OF STATE, *June 10, 1882.*

True copies.

SEVELLON A. BROWN, *Chief Clerk.*

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

DEPARTMENT OF STATE, *June 24, 1884.*

A true copy.

SEVELLON A. BROWN, *Chief Clerk.*

REPORT
OF THE
NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1907 the academy held three sessions. The first was the regular annual session, held at Washington April 16 to 18, inclusive; the second, a scientific session, held at New York November 19 and 20; the third, a special session, held at New York November 20 for the transaction of business.

ANNUAL MEETING.

The business meetings were held at the Smithsonian Institution and the scientific sessions in the lecture room of the United States National Museum.

The following members were present during the session: Messrs. Abbe, Abbot, Agassiz, Allen, Barker, Becker, Billings, Boas, Boss, Brewer, Brooks, Brush, Campbell, Cattell, Chandler (C. F.), Chittenden, Crafts, Dall, Emmons, Gill, Goodale, Hague, Howell, Merriam, Mitchell, Morley, Morse, Newcomb, Pupin, Remsen, Scott, Walcott, Webster, Welch, White, Wilson, Woodward, and Wright.

REPORT OF THE HOME SECRETARY.

The President of the National Academy of Sciences.

Sir: I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 16, 1907.

The annual report of the president of the academy for the year 1906 was transmitted to the United States Senate February 11, 1907, through the courtesy of Senator H. C. Lodge. The usual edition of 2,000 copies authorized by Congress was printed; 500 copies for the Senate, 1,000 copies for the House, and 500 copies for distribution by the Academy of Sciences. The report was received from the Government Printing Office April 6. Nearly one-half of the edition has been distributed to members of the academy, foreign associates, and such libraries and institutions as are on our domestic exchange list.

Since the last annual report the following memoirs, forming a part of Volume X of our scientific publications, have been issued: Fourth memoir, entitled "Phoronis architecta," by W. K. Brooks and R. P. Cowles; fifth memoir, entitled "On a new pyrosoma," by W. K. Brooks; sixth memoir, entitled "Commelinaceae," by Theodore Holm.

One-half of the edition has been received. The remainder is still at the Printing Office, to be held until the volume is complete, when the memoirs will be bound ready for distribution to reference libraries on our home and foreign exchange list. There are no memoirs now awaiting publication.

The following biographical memoirs have been published during the year: Clarence King, by Samuel F. Emmons; Charles E. Beecher, by William H. Dall; George P. Marsh, by William M. Davis; John Rodgers, by Asaph Hall; Fairman Rogers, by Edgar F. Smith; William A. Rogers, Part II, Astronomical Work, by Arthur Searle.

Messrs. Benjamin O. Peirce, Josiah Royce, and William B. Scott were elected members of the academy at the annual meeting in April, 1906. One member, Mr. Samuel L. Penfield, died August 13, 1906. Three foreign associates have died during the year: Ludwig Boltzmann, M. P. E. Berthelot, Henri Moissan. There are now 97 names on the membership list and 39 foreign associates.

ARNOLD HAGUE,
Home Secretary.

APRIL 16, 1907.

REPORT OF THE TREASURER.

WASHINGTON, D. C., *April 16, 1907.*

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my financial report as treasurer of the National Academy of Sciences for the year ending April 16, 1907:

Income.	General fund.	Baché fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.	Gould fund.	Emmons and Gill.	Building fund.
Balance brought forward:								
Cash	$287.69	$2,367.53	$1,298.52	$62.34	$591.91	$1,028.93	$316.95	$265.46
Invested income	4,500.00	2,000.00	155.94	....	2,015.43	1,000.00	....	....
Interest	631.38	2,291.17	1,105.97	440.07	384.36	906.25	65.00	67.50
Members' tax	465.00	....	....	....	....	....	....	....
Total	5,883.97	6,658.70	2,560.43	502.41	2,991.70	2,935.18	381.95	332.96
Transfer to capital fund	....	....	....	....	1,765.00	....	....	....
Disbursed	577.77	626.68	1,513.28	14.22	24.33	539.25	131.33	1.33
Balance:								
Cash	806.20	2,032.02	891.21	488.19	951.94	895.93	....	331.63
Invested income	4,500.00	4,000.00	155.94	....	250.43	1,500.00	250.62	....
Total	5,883.97	6,658.70	2,560.43	502.41	2,991.70	2,935.18	381.95	332.96

Respectfully,

S. F. EMMONS, *Treasurer.*

The treasurer's report was referred to an auditing committee composed of Messrs. Gill and Dall, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer.

Theo. N. Gill.
Wm. H. Dall.

REPORT OF THE WATSON TRUSTEES.

The first 12 tables of the Watson Asteroids, which it was hoped would be completed by the present time, have suffered a delay in consequence of the California earthquake. Several of the tables are, however, ready for printing, but Professor Leuschner, who is carrying on the work, has asked to retain the completed ones for reference until the whole 12 are ready, which he promises will be very soon. It is expected that three more tables will be finished by the end of the present year.

The trustees recommend that the entire work be published as two volumes or parts of the Memoirs of the Academy, one containing the tables, the other the researches on which they are founded.

Respectfully submitted.

Simon Newcomb.

The recommendation that the work on the Watson Asteroids be published as two volumes of the Memoirs of the Academy was approved.

REPORT OF THE COMMITTEE ON SOLAR RESEARCH.

The work of the International Union for Cooperation in Solar Research is described in detail in Volume I of the Transactions, a copy of which is presented herewith. Since the publication of this volume the committee on observations of sun-spot spectra and on work with the spectroheliograph have completed their reports, which provide for cooperation among observers in many parts of the world. These reports and those of other standing committees will receive final consideration at the third conference of the Union, which opens at the Astrophysical Observatory of Meudon, near Paris, on May 20, next. A report on the proceedings of this meeting and on the action of the International Association of Academies, which is to consider questions relating to the work of the Union at its coming meeting in Vienna, will be presented later.

Respectfully submitted.

George E. Hale, *Chairman.*

ELECTIONS.

ELECTION OF OFFICERS.

Mr. Ira Remsen was elected president of the Academy and Mr. Charles D. Walcott vice-president. Mr. Arnold Hague was reelected home secretary.

Messrs. Chittenden and Welch were elected to serve as members of the council for one year, Messrs. Agassiz and Woodward for two years, and Messrs. Hale and Osborn for three years.

ELECTION OF NEW MEMBERS.

Messrs. Joseph P. Iddings, Franklin P. Mall, Harmon N. Morse, and Elihu Thomson were elected members of the Academy.

ELECTION OF FOREIGN ASSOCIATES.

The following named gentlemen were elected foreign associates of the Academy: Sir James Dewar, of London; A. R. Forsyth, of Cambridge; David Hilbert, of Göttingen, and John C. Kapteyn, of Groningen.

LIST OF PAPERS PRESENTED AT THE APRIL SESSION.

Utilization of Ultra Violet Rays in Microscopy, and Demonstration of the Apparatus Employed (with lantern illustrations). W. T. Swingle and Lyman J. Briggs. (Introduced by C. Hart Merriam.)

On the Purification of the Isthmian Potable Water Supply (with lantern illustrations). Karl F. Kellerman. (Introduced by Theo. Gill.)

A New Horned Rodent from the Miocene of Kansas (with lantern illustrations). J. W. Gidley. (Introduced by C. D. Walcott.)

The Laramie Problem. F. H. Knowlton. (Introduced by Arnold Hague.)

Permo-Carboniferous Climatic Changes in South America. David White. (Introduced by W. H. Dall.)

On the Occurrence of European Genera of Fossil Cetacea in America. F. W. True. (Introduced by W. H. Dall.)

A New and More Accurate Form of Normal Barometer. J. M. Crafts.

The Catalysis of Sulphonic Acids in Concentrated Solutions. J. M. Crafts.

A Solution of the Vortices in the Atmospheres of the Earth and the Sun (with lantern illustrations). F. H. Bigelow. (Introduced by Cleveland Abbe.)

Results Thus Far Obtained by the Oceanic Magnetic Survey of the Carnegie Institution of Washington, and Their Bearing (with lantern illustrations). L. A. Bauer. (Introduced by S. Newcomb.)

The Relation of Radium to Hot Spring and Geyser Action (with lantern illustrations). Richard B. Moore. (Introduced by Arnold Hague.)

Exploration in the Upper Eocene of the Fayoum Desert (with lantern illustrations). Henry F. Osborn.

Remarks on the Solar Motion (with lantern illustrations). Lewis Boss.

Biographical Memoir of Samuel L. Penfield. Horace L. Wells.

Some New Measurements with the Gas Thermometer. A. L. Day. (Introduced by Geo. F. Becker.)

On the Optical Principles Involved in the Interpretation of the Canals of Mars. Simon Newcomb.

Methods of Detecting Correlations between the Variations of Fluctuating Quantities, with an Application to the Question of the Variability of the Sun's Radiation. Simon Newcomb.

The D. O. Mills Expedition to the Southern Hemisphere (with lantern illustrations). W. W. Campbell.

Results of the Intramercurial Planet Search. C. D. Perrine. (Introduced by W. W. Campbell.)

The Eggs of Flying Fishes. Alexander Agassiz.

The Elevated Reefs of the Windward Islands. Alexander Agassiz.

Biographical Memoir of Joseph Le Conte. E. W. Hilgard.

Continental Structure of Asia. Bailey Willis. (Introduced by Arnold Hague.)

The Occurrence of Elemental Silicon in a Meteoric Iron. Wirt Tassin. (Introduced by W. H. Dall.)

Description of Zeiss' Microscopic Apparatus for Ultra Violet Rays as Applied to the Study of Sponges. R. von Lendenfeld. (Presented by Alexander Agassiz.)

AUTUMN MEETING OF THE ACADEMY.

SCIENTIFIC SESSION.

[Held in New York, November 19 and 20, 1907.]

A scientific session for the reading of papers having been called by the council, the Academy met in Schermerhorn Hall, Columbia University, New York, November 19 and 20, 1907.

President Remsen presided at the sessions and the following members were in attendance: Messrs. Allen, Billings, Boas, Brewer, Brooks, Brush, Cattell, Chandler (C. F.), Chittenden, Dana, Davis, Dutton, Elkin, Emmons, Gooch, Hague, Hastings, Hill, Minot, Morse (E. S.), Newcomb, Nichols, Noyes, Osborn, Pickering, Pupin, Thomson, Verrill, Walcott, Webster, Welch, Wells, Wilson, and Woodward.

The following papers were presented:

A New Application of Dynamics to Electrical Circuits. M. I. Pupin.

The Selective Reflection Characteristic of Carbonates; Wave Length of Displacement a Function of the Atomic Weight of the Base. Leighton B. Morse. (Introduced by M. I. Pupin.)

Oxygen the Active Atom in the Characteristic Reflection of Carbonates, Nitrates, Sulphates and Silicates. Leighton B. Morse. (Introduced by M. I. Pupin.)

A Modification of the Bjerkness Hydrodynamics Analogy. A. P. Wills. (Introduced by M. I. Pupin.)

Psycho-physical Investigations with the Galvanometer and Pneumograph. Frederick Peterson. (Introduced by M. I. Pupin.)

On Rayleigh's Disc as an Absolute Measure of Sound. A. G. Webster.

On the Minimum Audible Sound. George E. Stebbins. (Introduced by A. G. Webster.)

Buried River Channels of the Hudson Valley. J. F. Kemp. (Introduced by A. G. Webster.)

Glacial Erosion in Wales. W. M. Davis.

Summary of Studies of Cambrian Brachiopods. Charles D. Walcott.

On Certain Changes of Nuclei in Relation to Age. Charles S. Minot.

Researches from the Psychological Laboratory of Columbia University. J. McK. Cattell.

Additions to the Collections of Extinct Vertebrates in the American Museum of Natural History. H. F. Osborn.

A Biographical Memoir of Alpheus Hyatt. W. K. Brooks.

Biography of Lewis H. Morgan. W. H. Holmes.

Drop Weight and the Law of Tate; the Determination of the Molecular Weight in the Liquid State by the Aid of Drop Weights. Reston Stevenson and J. Livingston Morgan. (Introduced by Charles F. Chandler.)

The Relation of the Spectra, Magnitudes, and Colors of Stars. Edward C. Pickering.

Tables of Minor Planets discovered by James C. Watson. Prepared by Armin O. Leuschner under direction of the Watson Trustees of the National Academy of Sciences. Simon Newcomb.

BUSINESS MEETING.

[New York, November 20, 1907.]

The President announced that General Cyrus B. Comstock had presented to the Academy the generous gift of $10,000, the interest of said fund to be devoted to the advancement of knowledge in electricity, magnetism, and radiant energy.

The gift was accepted by a unanimous vote of the members present. The terms of the gift are as follows:

DEED OF TRUST AND ACCEPTANCE, DATED NOVEMBER 27, 1907.

Know all men by these presents: That I, Cyrus B. Comstock, of the city of New York, to advance knowledge in electricity, magnetism, and radiant energy, by the giving of money prizes for important investigations or discoveries in those subjects, have given, assigned, transferred and set over, and do by these presents give, assign, transfer and set over unto the National Academy of Sciences, incorporated by the act of Congress approved March 3, 1863, and its several supplements, and hereinafter designated as the trustee, and unto its successor or successors, ten (10) Union Pacific Railroad Company registered first-mortgage railroad and land-grant four-per-cent gold bonds, Numbers B588, B663, B993, B994, B1106, B1204, B1282, B1290, B1309, B1369, each for $1,000, and my check for four hundred dollars ($400), bearing even date herewith and payable to the order of the National Academy of Sciences;

To have and to hold the same unto the said National Academy of Sciences, its successor or successors in trust and upon the following conditions, to wit:

First. The trustee shall keep said sum of four hundred dollars ($400), and said bonds, or the proceeds thereof and all additions thereto, as a separate fund to be known as the Cyrus B. Comstock fund.

Second. The trustee shall have power at any time in its discretion to sell said bonds or any of them and execute a proper assignment thereof to the purchaser or purchasers, and shall invest the proceeds thereof and all moneys forming a part of said fund, and keep the same invested in such securities and in such manner as its constitution shall provide for the investment of its property or as shall be authorized by law for the investment of trust funds.

Third. The trustee shall collect the income arising from said fund and apply the same as follows:

(1) The market value of the fund shall be maintained at not less than ten thousand dollars ($10,000), and any and all depreciation therein shall be made up out of the income of the fund before any part of such income shall be applied as hereinafter provided. But when, by the additions hereinafter authorized and directed, the principal of the fund shall have been increased in the amount of five thousand dollars ($5,000), then and thereafter the market value of the fund shall be maintained in the manner aforesaid at not less than fifteen thousand dollars ($15,000).

(2) The balance of the income of said fund shall be set aside and accumulated, and out of such accumulations the trustee shall award once for every five years a prize in money to the bona fide resident of North America, who, not less than one year nor more than six years before the awarding of the prize, shall have made in the judgment of the trustee the most important discovery or investigation in electricity or magnetism or radiant energy.

Such prize shall be known and designated as the "Comstock prize," and shall be in an amount equal to about two-thirds of said balance of the income of said fund for the five years for which the award shall be made, and shall be paid to the person to whom the prize shall have been awarded at such time as may be convenient to the trustee, but the awarding thereof shall be entirely and in all respects in the discretion of the trustee. If no such discovery or investigation shall be deemed by the trustee to be worthy of the prize, or if for any other reason the prize shall not be awarded for any period of five years, then and in that event the money which might have been awarded shall be added to the principal of the fund and become a part thereof; but the trustee may in its discretion use the whole or any part of the amount unawarded for any five years in aiding such investigation or investigations as the trustee shall deem worthy in electricity, magnetism or radiant energy to be made by a bona fide resident or residents of North America; provided, however, that the prize shall not be diverted to give such aid oftener than once in fifteen years.

(3) The balance of the income so accumulated, less the amount to be awarded as a prize, as provided in the preceding section, shall be added to the principal of the fund and become a part thereof and subject to the terms and conditions herein contained, as though such additions had been part of the original donation; provided, however, that when the market value of said fund shall have been increased to fifteen thousand dollars ($15,000), the amount of the prize may be increased in the discretion of the trustee to more than two-thirds of the net income as above provided.

Fourth. Upon the failure or inability of the trustee, its successor or successors, to carry out the said trust upon the terms and conditions above set forth, said fund together with all accumulations and unexpended income shall revert to me, the said Cyrus B. Comstock, if then living; if dead, to my heirs at law who shall then be living, per stirpes and not per capita.

In witness whereof, I, the said Cyrus B. Comstock, have hereunto and unto a duplicate hereof, set my hand and seal this twenty-seventh day of November, one thousand nine hundred and seven.

CYRUS B. COMSTOCK.

In presence of—
MONCURE MARCH.

STATE OF NEW YORK, *County of New York*, ss:

On this twenty-seventh day of November, in the year of our Lord one thousand nine hundred and seven, before me personally came Cyrus B. Comstock, to me personally known, and known to me to be the individual described in and who executed the above instrument, and he duly acknowledged to me that he executed the same.

MONCURE MARCH,
Notary Public, New York Co.

Know all men by these presents: That the National Academy of Sciences, the trustee named in the foregoing instrument, hereby acknowledges the receipt from the said Cyrus B. Comstock of said ten (10) Union Pacific Railroad Company registered first-mortgage railroad and land-grant four-per-cent gold bonds, Numbers B588, B663, B993, B994, B1106, B1204, B1282, B1290, B1309, B1369, each for $1,000, duly assigned to the said National Academy of Sciences as trustee under the foregoing instrument, and his check for four hundred dollars ($400), payable to the order of the National Academy of Sciences; and that, by authority of its council, the said trustee hereby accepts and agrees to hold the same in trust and upon the terms and conditions above set forth.

And the said National Academy of Sciences hereby constitutes and appoints Ira Remsen its true and lawful attorney, for it and in its name to acknowledge this instrument, and a duplicate hereof, to be its act before any person having authority to take such acknowledgment.

In witness whereof, the said the National Academy of Sciences has caused its corporate seal to be hereunto and unto a duplicate hereof affixed, and these presents, and a duplicate hereof, to be signed in its name by its president and treasurer this thirtieth day of November, one thousand nine hundred and seven.

NATIONAL ACADEMY OF SCIENCES,
By IRA REMSEN, *President.*
S. F. EMMONS, *Treasurer.*

STATE OF MARYLAND, *City of Baltimore, ss:*

I, John R. Hooper, a notary public in and for the city and State aforesaid, do hereby certify that on this 4th day of December, 1907, before me personally appeared Ira Remsen, to me known and known to me to be the attorney named in the above instrument in writing and acknowledged the foregoing instrument to be the act of the National Academy of Sciences therein described.

In witness whereof, I have hereunto set my hand and seal this 4th day of December, one thousand nine hundred and seven.

John R. Hooper,
Notary Public.

REPORT OF THE COMMITTEE ON COOPERATIVE RESEARCH IN CHEMISTRY.

November 15, 1907.

The committee on cooperative research in chemistry presents to the Academy the following report:

In accordance with the authorization granted at the meeting of November 21, 1906, the committee has added to its membership Prof. Gilbert N. Lewis and has proceeded, in pursuance of the instructions of the Academy, to develop in detail the plan previously outlined of securing the cooperation of the chemists of this country in a systematic investigation of the large and important problem of determining the maximum quantity of work producible by chemical reactions, or the so-called free-energy change attending them—a quantity which has a much greater significance than even the heat-effect or total-energy change accompanying the reaction, because its numerical value and sign determines the conditions of the equilibrium of the reaction and the direction in which under given conditions it tends to take place. The committee has drawn up a form of letter describing the purposes and importance of this field of investigation and the plan of cooperative research in it indorsed by the Academy. It has also prepared a brief memorandum in regard to the principles of the two methods available for the determination of maximum work, which are based respectively on a measurement of the electromotive force of suitable combinations of the substances involved and on a direct study of the equilibrium of the reaction itself. This memorandum also includes examples of previous researches and a statement of some important specific problems which await investigation. It is proposed to send this letter to those in charge of the chemical and physical departments of higher educational institutions of the country and to others who might be interested, inviting their individual cooperation and that of the members of their staff.

The committee has also prepared a more complete treatise upon the principles of energetics underlying the determination of the free-energy change attending physicochemical changes and chemical reactions, and one of the members of the committee (Professor Lewis) is engaged in the preparation of a critical summary of the existing data relating to specific reactions and of a recomputation from those data of best values for the free energy of individual chemical compounds. It is planned to print these treatises and to furnish them at cost to any investigator who expresses active interest or a desire to take part in the undertaking.

The committee also desires to report that it has received from the trustees of the William E. Hale research fund $300 to be used in defraying the expenses incurred in carrying out the proposed plan of cooperative research, but that it has not as yet been necessary to use any of this generous contribution.

The committee wishes, finally, to request that, provided the plan meets with the approval of the Academy, it be authorized to proceed with its execution along the lines indicated by this report.

Arthur A. Noyes.
Edward W. Morley.
Theodore Wm. Richards.
Gilbert N. Lewis.

A resolution was adopted authorizing the committee to proceed with the investigation as outlined in the report.

FORM OF LETTER TO BE SENT TO HEADS OF DEPARTMENTS AND RESEARCH WORKERS IN EDUCATIONAL INSTITUTIONS.

National Academy of Sciences,
Committee on Cooperative Research in Chemistry,
Boston, Mass., *Jan. 1, 1908.*

Dear Sir: The undersigned committee of the National Academy of Sciences desires to bring to your attention a plan of cooperative chemical research which is to be executed under the auspices of the Academy. The purpose of this plan is to promote by systematic investigation a knowledge of the amounts of work producible by chemical reactions or of the so-called free-energy change attending them. As you are aware, this quantity is one of fundamental importance not only because it is a direct measure of the magnitude of the mechanical work or electrical energy obtainable from chemical changes, but also, and especially, because it is known to be the factor which alone determines the condition of equilibrium of such changes and the direction in which, under specified conditions, they tend to take place. Thus it has as a measure of chemical affinity the significance which, prior to the development of the science of energetics, was often erroneously attributed to the heat-effect or total-energy change attending chemical reactions. Yet its value is known with even a moderate degree of accuracy for only a comparatively few chemical changes, partly because its significance has only recently been realized and partly because no generally applicable methods are available similar to those used for thermochemical measurements, so that there must be devised for each specific reaction a suitable method which may be based either on a study of its equilibrium conditions or on a measurement of the electromotive force of a voltaic cell in which the reaction takes place.

The intrinsic importance of this problem, the vast amount of experimental investigation required for its solution, the desirability of correlating the researches upon it so that the connected data needed for the systematic treatment of integral parts of the subject may soon be available, combine to make extensive cooperation in the execution of the investigation highly desirable. The fact that the work does not involve routine measurements by a perfected method, but requires the exercise of much originality and skill in planning the experiments, should, moreover, make the field an attractive one both from a theoretical and manipulative standpoint.

Led by these considerations the National Academy of Sciences has decided to take the initiative in the attempt to promote cooperation among chemists and physicists of the country in this field of scientific research; and its committee requests your individual cooperation in the plan by informing it of any researches upon chemical equilibrium or electromotive force that may already be in progress in your laboratories, by instituting such new investigations in these directions as will most contribute to rounding out our knowledge of the data pertaining to important divisions of the subject, and especially by inducing the junior members of your staff to take up some research of this character. One of the main purposes of the Academy in this undertaking is to stimulate the younger members of the instructing staffs of our educational institutions to engage in research work. For it is believed that there are many such men who would take up scientific investigation if they knew of definite problems of importance and not too great complexity of which they could undertake the study, especially if they were also made to appreciate that their academic superiors considered duly proportioned activity in this direction to be no less an obligation than attention to the work of instruction. Those who are interested in the problems here under consideration or in other important lines of research will of course prefer to choose their own subjects for investigation; and the committee would regard it as unfortunate to limit individual initiative in this matter; but, on the other hand, the committee will gladly render any desired assistance in the selection of a research subject and in devising a promising method of attacking it.

To give a clearer understanding of the nature of the problem and the character of the experimental investigations required for its solution, a brief printed statement entitled The Maximum Work Producible by Chemical Reactions has been prepared, and this will be furnished without charge to any one desiring it. In order to enable those engaged or wishing to engage in such investigations to plan their researches to better advantage, and in order to secure greater uniformity in the presentation of results, there has also been prepared a more extensive treatment of the energy principles involved and their applications to the problem in question. This is entitled The Principles of Energetics and Their Application to Chemical and Physico-Chemical Changes, and will be furnished to those interested at a charge of a few cents, sufficient to cover the cost of printing. A critical summary of the results previously obtained in the field of inorganic compounds is in preparation by one of the members of the committee, Prof. Gilbert N. Lewis. This will be entitled The Free Energy of Chemical Compounds and will show not only the present state of our knowledge, but will indicate also the new data which are most needed to supplement the existing ones.

Your cooperation in the plan of research here outlined is earnestly solicited, and to that end the committee makes the following specific requests:

(1) That it be informed of any investigations in progress or in prospect in your laboratories relating to the electromotive force of chemical combinations, to the equilibrium of chemical reactions, to their heat effects, or to the heat-capacities of chemical substances. This will enable the committee to act as a central clearing-house for such investigations.

(2) That, so far as may seem practicable and not prejudicial to research work already in progress, investigations in these directions be undertaken under your supervision by your students and assistants, and that the attention of other members of your staff be called to this plan of cooperative research.

(3) That you place in communication with the committee any of the younger members of your staff who, in your opinion, have the interest, ability, and opportunity to undertake investigations of this character, and who may desire to carry them on with the assistance or cooperation of the committee.

All correspondence should be addressed to the secretary of the committee, Prof. Gilbert N. Lewis, Massachusetts Institute of Technology, Boston, Mass.

Edward W. Morley,
Arthur A. Noyes,
Theodore W. Richards,
Gilbert N. Lewis,
Committee on Cooperative Research in Chemistry of the National Academy of Sciences.

APPOINTMENTS.

Mr. T. C. Chamberlain was appointed a delegate to represent the Academy at the celebration of the fiftieth anniversary of the Michigan Agricultural College, Lansing, May 28 to 31; Mr. Alexander Agassiz, at the Seventh International Zoological Congress, Boston, August 19 to 23; Mr. Arnold Hague, at the Centenary Celebration of the Geological Society of London, September 26 to 28; Mr. George E. Hale, at the meeting of the International Association of Academies at Vienna in May and at the third meeting of the International Union for Cooperation in Solar Research, held in Paris during the week beginning May 20; Mr. W. C. Brögger, at the bicentenary of the birth of Carolus Linnæus at Upsala, Sweden; Mr. Henry F. Osborn at the celebration of the two hundredth anniversary of the birth of Carolus Linnæus at New York.

DEATHS DURING THE YEAR.

Asaph Hall died on the 22d of November, 1907.

Five foreign associates also died during the year: Maurice Loewy and J. Janssen, of Paris; D. I. Mendeleeff, of St. Petersburg; H. C. Vogel, of Potsdam; and Lord Kelvin, of London.

APPENDICES.

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APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY OF SCIENCES.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907; November 20, 1907.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The Academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the Academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the Academy.

SEC. 3. The Academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the Academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the Academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the Academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six

years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the Academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the Academy until the next stated session of the Academy.

Sec. 2. The officers of the Academy, together with six members to be elected by the Academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the Academy.

Sec. 3. The president of the Academy, or in case of his absence or inability to act the vice-president shall preside at the meetings of the Academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the Academy at its sessions next ensuing; and, with the council, shall direct the general business of the Academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the Academy.

Sec. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the Academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

Sec. 5. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the Academy.

Article III.—OF THE MEETINGS.

Sec. 1. The Academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the Academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the Academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the Academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the Academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the Academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the first stated session in each year.

SEC. 4. Nominations to membership in the Academy shall be made in writing, approved by a majority of the members of the committee on the subject in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the Academy.

SEC. 5. The Academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the Academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Election to membership shall be held as described below. There shall be two ballots, a preference ballot, which may be prepared either before or at the meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

1. *Preference ballot.*—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

2. *Final ballot.*—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than twenty votes in all, provided that the number of members of the Academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

Election of members shall be held at the regular stated session of each year held in Washington, and not more than 10 members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

Sec. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

Sec. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council, and may be elected at the regular stated session of each year, held in Washington, by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the Academy with the notice of the meeting at which the election is to be held.

Recommendations for nomination of foreign associates may be sent to the home secretary at any time.

Sec. 8. A diploma, with the corporate seal of the Academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

Sec. 9. Resignations shall be addressed to the president and acted on by the Academy.

Sec. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the Academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the Academy and his name shall be dropped from the roll.

Article V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

Sec. 1. Communications on scientific subjects shall be read at scientific meetings of the Academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

Sec. 2. Any member of the Academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

Sec. 3. The Academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

Sec. 4. Propositions for investigations or reports by the Academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained, and to the Academy at its next following stated session.

Sec. 5. The advice of the Academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

Sec. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the Academy, at one of the stated sessions.

Sec. 7. Medals and prizes may be established, and the means of bestowing them accepted by the Academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the Academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the Academy, in stocks of the United States, or, with the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the Academy.

SEC. 2. No contract shall be binding upon the Academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the Academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the Academy. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee of three members, to be appointed by the president at the meeting at which the accounts are presented, which committee shall report before the close of that session, and shall then be discharged.

The bonds, securities, and other property owned or held in trust by the Academy shall be inspected and verified by a committee to be annually appointed by the president. The report of this committee shall be presented to the Academy at its first stated session in each year and referred with the accounts to the auditing committee.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the Academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.

5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the Academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the Academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the Academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the Academy.

X. Memoirs shall date, in the records of the Academy, from the date of their presentation to the Academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the Academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the Academy as early as practicable, and not later than the next stated session.

XII. The annual report of the Academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the Academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the Academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the Academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of Departments of the Government, and in each case to look to the Department requesting the investigation for reimbursement to the Academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the Academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the Academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

XXI. Any rule of the Academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the Academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the Academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1907-8.

	Expiration of term.
Remsen, Ira, *President*	April, 1913.
Walcott, C. D., *Vice-President*	April, 1913.
Newcomb, Simon, *Foreign Secretary*	April, 1909.
Hague, Arnold, *Home Secretary*	April, 1913.
Emmons, S. F., *Treasurer*	April, 1908.

ADDITIONAL MEMBERS OF COUNCIL.

1907-8.

Chittenden, R. H.
Welch, W. H.

1907-1909.

Agassiz, Alexander.
Woodward, R. S.

1907-1910.

Hale, George E.
Osborn, Henry F.

COMMITTEES OF THE ACADEMY.

On nominations of new members.

1. Mathematics and Astronomy.
   - Abbe, C.
   - Boss, Lewis.
   - Campbell, W. W.
   - Chandler, S. C.
   - Comstock, G. C.
   - Davidson, G.
   - Elkin, W. L.
   - Hale, G. E.
   - Hill, G. W.
   - Holden, E. S.
   - Moore, E. H.
   - Newcomb, S.
   - Osgood, W. F.
   - Peirce, C. S.
   - Pickering, E. C.
   - Webster, A. G.
   - Woodward, R. S.
2. Physics and Engineering.
   - Abbe, C.
   - Abbot, H. L.
   - Barker, G. F.
   - Barus, C.
   - Bell, A. G.
   - Comstock, C. B.

2. Physics and Engineering—Cont'd.
   - Hastings, C. S.
   - Mendenhall, T. C.
   - Michelson, A. A.
   - Morley, E. W.
   - Nichols, E. L.
   - Noyes, A. A.
   - Peirce, B. O.
   - Pickering, E. C.
   - Pupin, M. I.
   - Thomson, Elihu.
   - Trowbridge, J.
   - Webster, A. G.
   - Woodward, R. S.
   - Wright, A. W.
3. Chemistry.
   - Barker, G. F.
   - Brush, G. J.
   - Chandler, C. F.
   - Chittenden, R. H.
   - Crafts, J. M.
   - Dana, E. S.
   - Gibbs, W.
   - Gooch, F. A.
   - Hilgard, E. W.

3. Chemistry—Continued.
   - Jackson, C. L.
   - Johnson, S. W.
   - Michael, A.
   - Morley, E. W.
   - Morse, H. N.
   - Nef, John U.
   - Noyes, A. A.
   - Remsen, Ira.
   - Richards, T. W.
   - Smith, E. F.
   - Wells, H. L.

4. Geology and Paleontology.
   - Agassiz, A.
   - Becker, G. F.
   - Branner, J. C.
   - Chamberlin, T. C.
   - Dall, W. H.
   - Davis, W. M.
   - Dutton, C. E.
   - Emmons, S. F.
   - Gilbert, G. K.
   - Hague, Arnold.
   - Iddings, J. P.
   - Osborn, H. F.
   - Pumpelly, R.
   - Scott, W. B.
   - Van Hise, C. R.
   - Walcott, C. D.
   - White, C. A.

5. Biology.
   - Agassiz, A.
   - Allen, J. A.
   - Bowditch, H. P.
   - Brewer, W. H.
   - Brooks, W. K.
   - Chittenden, R. H.
   - Councilman, W. T.
   - Dall, W. H.

5. Biology—Continued.
   - Farlow, W. G.
   - Gill, T. N.
   - Goodale, G. L.
   - Howell, W. H.
   - Mall, F. P.
   - Mark, E. L.
   - Merriam, C. H.
   - Minot, C. S.
   - Morse, E. S.
   - Osborn, H. F.
   - Prudden, T. M.
   - Putnam, F. W.
   - Sargent, C. S.
   - Scudder, S. H.
   - Smith, S. I.
   - Trelease, William.
   - Verrill, A. E.
   - Walcott, C. D.
   - Welch, W. H.
   - White, C. A.
   - Whitman, C. O.
   - Wilson, E. B.
   - Wood, H. C.

6. Anthropology.
   - Billings, J. S.
   - Boas, Franz.
   - Cattell, J. McK.
   - Holmes, W. H.
   - James, Wm.
   - Merriam, C. H.
   - Minot, C. S.
   - Mitchell, S. W.
   - Morse, E. S.
   - Peirce, C. S.
   - Putnam, F. W.
   - Royce, Josiah.
   - Welch, W. H.

On Weights, Measures, and Coinage.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Newcomb, S.
Peirce, C. S.
Comstock, C. B.
Woodward, R. S.
Morley, E. W.

On the Election of Foreign Associates.

Remsen, Ira, *Chairman.*
Brush, G. J.
Mitchell, S. W.
Newcomb, S.
Osborn, H. F.

On Publication.

The President.
The Home Secretary.
Walcott, C. D.

On Solar Research.

Hale, George E., *Chairman.*
Campbell, W. W.
Michelson, A. A.
Comstock, G. C.

TRUST FUNDS.

Board of Direction of the Bache Fund.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Chandler, S. C., *Chairman.*
Bowditch, H. P.
Remsen, Ira.

Board of Trustees of the Watson Fund.

[1893, residual estate, $18,666.88.]

For the promotion of astronomical research.

Newcomb, S., *Chairman.*
Elkin, W. L.
Boss, L.

The Henry Draper Fund.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Newcomb, S., *Chairman.*
Hale, G. E.
Trowbridge, John.
Wright, A. W.
Michelson, A. A.

The J. Lawrence Smith Fund.

[1885, $8,000.]

For the investigation of meteoric bodies.

Morley, E. W., *Chairman.*
Dana, E. S.
Johnson, S. W.
Pumpelly, R.
Remsen, Ira.

The Benjamin Apthorp Gould Fund.

[1897, $20,000.]

For researches in astronomy.

Boss, Lewis, *Chairman.*
Chandler, S. C.
Hill, G. W.

The Barnard Medal.

Billings, J. S., *Chairman.*
Bowditch, H. P.
Chandler, S. C.
Jackson, C. L.
Newcomb, S.
Nichols, E. L.

The Wolcott Gibbs Fund.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman.*
Remsen, Ira.
Smith, Edgar F.

Joseph Henry Fund.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES.
JANUARY 31, 1908.

		Date of election.
ABBE, CLEVELAND	*U. S. Weather Bureau, Washington, D. C.*	1879
ABBOT, HENRY L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
AGASSIZ, ALEXANDER	*Cambridge, Mass.*	1866
ALLEN, J. ASAPH	*American Museum, New York City.*	1876
BARKER, GEORGE F	*3909 Locust st., Philadelphia, Pa.*	1876
BARUS, CARL	*Brown University, Providence, R. I.*	1892
BECKER, GEORGE F	*U. S. Geological Survey, Washington, D. C.*	1901
BELL, A. GRAHAM	*1331 Connecticut ave., Washington, D. C.*	1883
BILLINGS, JOHN S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
BOAS, FRANZ	*123 W. Eighty-second st., New York City.*	1900
BOSS, LEWIS	*Dudley Observatory, Albany, N. Y.*	1889
BOWDITCH, HENRY P	*Harvard Medical School, Boston, Mass.*	1887
BRANNER, JOHN C	*Stanford University, California.*	1905
BREWER, WILLIAM H	*418 Orange st., New Haven, Conn.*	1880
BROOKS, W. K	*Johns Hopkins University, Baltimore, Md.*	1884
BRUSH, GEORGE J	*14 Trumbull st., New Haven, Conn.*	1868
CAMPBELL, WILLIAM W	*Lick Observatory, Mt. Hamilton, California.*	1902
CATTELL, JAMES MCK	*Garrison, N. Y.*	1901
CHAMBERLIN, THOMAS C	*University of Chicago, Chicago, Ill.*	1903
CHANDLER, CHARLES F	*Columbia University, New York City.*	1874
CHANDLER, SETH C	*Box 216, Wellesley Hills, Mass.*	1888
CHITTENDEN, RUSSELL H	*Sheffield Scientific School, New Haven, Conn.*	1890
COMSTOCK, CYRUS B., U. S. A	*124 E. Twenty-seventh st., New York City.*	1884
COMSTOCK, GEORGE C	*Washburn Observatory, Madison, Wis.*	1899
COUNCILMAN, WM. T	*Harvard Medical School, Boston, Mass.*	1904
CRAFTS, JAMES M	*59 Marlborough st., Boston, Mass.*	1872
DALL, WILLIAM H	*Smithsonian Institution, Washington, D. C.*	1897
DANA, EDWARD S	*Yale University, New Haven, Conn.*	1884
DAVIDSON, GEORGE	*2221 Washington st., San Francisco, Cal.*	1874
DAVIS, WILLIAM MORRIS	*17 Francis ave., Cambridge, Mass.*	1904
DUTTON, CLARENCE E., U. S. A	*Englewood, N. J.*	1884
ELKIN, WILLIAM L	*Yale University Observatory, New Haven, Conn.*	1895
EMMONS, SAMUEL F	*U. S. Geological Survey, Washington, D. C.*	1892
FARLOW, W. G	*Harvard University, Cambridge, Mass.*	1879
GIBBS, WOLCOTT	*Newport, R. I.*	——
GILBERT, GROVE K	*U. S. Geological Survey, Washington, D. C.*	1883
GILL, THEODORE N	*Smithsonian Institution, Washington, D. C.*	1873
GOOCH, FRANK A	*Yale University, New Haven, Conn.*	1897
GOODALE, GEORGE L	*Harvard University, Cambridge, Mass.*	1890
HAGUE, ARNOLD	*U. S. Geological Survey, Washington, D. C.*	1885

		Date of election.
Hale, George E.	*Solar Observatory, Mount Wilson, Cal.*	1902
Hastings, Charles S.	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W.	*University of California, Berkeley, Cal.*	1872
Hill, George W.	*West Nyack, N. Y.*	1874
Holden, Edward S.	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H.	*Bureau of American Ethnology, Washington, D. C.*	1905
Howell, William H.	*232 W. Lanvale st., Baltimore, Md.*	1905
Iddings, Joseph P.	*University of Chicago, Chicago, Ill.*	1907
Jackson, Charles L.	*6 Boylston Hall, Cambridge, Mass.*	1883
James, William	*95 Irving st., Cambridge, Mass.*	1903
Johnson, Samuel W.	*54 Trumbull st., New Haven, Conn.*	1866
Mall, Franklin P.	*Anatom. Lab., Sta. O, Baltimore, Md.*	1907
Mark, Edward L.	*109 Irving st., Cambridge, Mass.*	1903
Mendenhall, Thomas C.	*Worcester, Mass.*	1887
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A.	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S.	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H.	*University of Chicago, Chicago, Ill.*	1901
Morley, Edward W.	*West Hartford, Conn.*	1897
Morse, Edward S.	*P. O. Box 268, Salem, Mass.*	1876
Morse, Harmon N.	*Johns Hopkins University, Baltimore, Md.*	1907
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Newcomb, Simon, U. S. N.	*1620 P st. NW., Washington, D. C.*	1869
Nichols, Edward L.	*Cornell University, Ithaca, N. Y.*	1901
Noyes, Arthur A.	*Massachusetts Institute of Technology, Boston, Mass.*	1905
Osborn, H. F.	*American Museum of Natural History, New York City.*	1900
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Benjamin O.	*Harvard University, Cambridge, Mass.*	1906
Peirce, Charles S.	*Milford, Pa.*	1876
Pickering, Edward C.	*Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Pupin, Michael I.	*Columbia University, New York City.*	1905
Putnam, Frederick W.	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W.	*Harvard University, Cambridge, Mass.*	1899
Royce, Josiah	*Harvard University, Cambridge, Mass.*	1906
Sargent, Charles S.	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scott, William B.	*Princeton, N. J.*	1906
Scudder, Samuel H.	*Cambridge, Mass.*	1877
Smith, Edgar F.	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Sidney I.	*Yale University, New Haven, Conn.*	1884
Thomson, Elihu	*Swampscott, Mass.*	1907
Trelease, Wm.	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R.	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E.	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D.	*Smithsonian Institution, Washington, D. C.*	1896
Webster, Arthur G.	*Clark University, Worcester, Mass.*	1903
Welch, William H.	*807 St. Paul st., Baltimore, Md.*	1895
Wells, Horace L.	*Yale University, New Haven, Conn.*	1903

		Date of election.
White, Charles A.	*1908 13th st., NW., Washington, D. C.*	1889
Whitman, Charles O.	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B.	*Columbia University, New York City.*	1899
Wood, Horatio C.	*4107 Chester ave., Philadelphia, Pa.*	1879
Woodward, Robert S.	*Carnegie Institution, Washington, D. C.*	1896
Wright, Arthur W.	*Yale University, New Haven, Conn.*	1881

FOREIGN ASSOCIATES.

Auwers, Arthur	*Berlin.*
Backlund, Oskar	*Pulkowa.*
Baeyer, Adolph Ritter von	*Munich.*
Becquerel, Henri	*Paris.*
Berthelot, M. P. E.	*Paris.*
Bornet, Edouard	*Paris.*
Brögger, W. C.	*Christiania.*
Darwin, Sir George	*Cambridge.*
Dewar, Sir James	*London.*
Ehrlich, Paul	*Frankfurt-am-Main.*
Fischer, Emil	*Berlin.*
Forsyth, A. R.	*Cambridge.*
Geikie, Sir Archibald	*Haslemere, Surrey.*
Gill, Sir David	*Cape Town.*
Groth, Paul von	*Munich.*
Hilbert, David	*Göttingen.*
Hoff, J. H. van't	*Berlin.*
Hooker, Sir J. D.	*London.*
Huggins, Sir William	*London.*
Kapteyn, John C.	*Groningen.*
Klein, Felix	*Göttingen.*
Koch, Robert	*Berlin.*
Kohlrausch, Friedrich	*Marburg.*
Kronecker, Hugo	*Berne.*
Lankester, E. Ray	*London.*
Lister, Lord	*London.*
Lorentz, Hendrik Anton	*Leiden.*
Moissan, Henri	*Paris.*
Ostwald, Wilhelm	*Leipzig.*
Pfeffer, Wilhelm	*Leipzig.*
Picard, Emile	*Paris.*
Poincaré, Henri	*Paris.*
Ramsay, Sir William	*London.*
Rayleigh, Lord	*London.*
Rosenbusch, H.	*Heidelberg.*
Strasburger, Edouard	*Bonn.*
Suess, Edouard	*Vienna.*
Thomson, Joseph John	*Cambridge.*
Vries, Hugo de	*Amsterdam.*
Zirkel, Ferdinand	*Leipzig.*

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Louis*		Dec. 14, 1873
Alexander, J. H.*		Mar. 2, 1867
Alexander, Stephen*		June 25, 1883
Bache, Alexander Dallas*		Feb. 14, 1867
Baird, Spencer F.*	1864	Aug. 19, 1887
Barnard, F. A. P		Apr. 27, 1889
Barnard, J. G.*		May 14, 1882
Bartlett, W. H. C		Feb. 11, 1893
Beecher, Charles Emerson*	1899	Feb. 14, 1904
Brown-Sequard, Charles E.*	1868	Apr. 2, 1894
Casey, Thomas L.*	1890	Mar. 25, 1896
Caswell, Alexis		Jan. 8, 1887
Chauvenet, William*		Dec. 13, 1870
Clarke, Henry James*	1872	July 1, 1873
Coffin, James*	1869	Jan. 6, 1873
Coffin, J. H. C		Jan. 8, 1890
Cook, George H.*	1887	Sept. 22, 1889
Cooke, Josiah P.*	1872	Sept. 3, 1894
Cope, Edward D.*	1872	Apr. 12, 1897
Coues, Elliott	1877	Dec. 25, 1899
Dalton, J. C.*	1864	Feb. 2, 1889
Dana, James D		Apr. 14, 1895
Davis, Charles H.*		Feb. 14, 1877
Draper, Henry*	1877	Nov. 20, 1882
Draper, John W.*	1877	Jan. 4, 1882
Eads, James B.*	1872	Mar. 8, 1887
Engelmann, George*		Feb. 4, 1884
Ferrel, William*	1868	Sept. 18, 1891
Frazer, John Fries*		Oct. 12, 1872
Gabb, William M	1876	May 30, 1878
Genth, F. A.*	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gilliss, James Melville*		Feb. 9, 1865
Goode, G. Brown*	1888	Sept. 6, 1896
Gould, Augustus A.*		Sept. 15, 1866
Gould, Benjamin A		Nov. 27, 1896
Gray, Asa*		Jan. 30, 1888
Guyot, Arnold*		Feb. 8, 1884
Hadley, James*	1864	Aug. 1, 1872
Haldeman, S. S.*	1876	Sept. 20, 1880
Hall, Asaph	1875	Nov. 22, 1907
Hall, James		Aug. 8, 1898
Hayden, F. V.*	1873	Dec. 22, 1887
Henry, Joseph*		May 13, 1878
Hilgard, Julius E.*		May 8, 1891
Hill, Henry B.*	1883	Apr. 6, 1903
Hitchcock, Edward*		Feb. 27, 1864
Holbrook, J. E.*	1868	Sept. 8, 1871
Hubbard, J. S.*		Aug. 16, 1863
Humphreys, A. A.*		Nov. 28, 1883
Hunt, T. Sterry	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Keeler, J. E.*	1900	Aug. 12, 1900
King, Clarence*	1876	Dec. 24, 1901
Kirkland, Jared P.*	1865	Dec. 10, 1877

* Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death.
LANE, J. HOMER *	1872	May 3, 1880
LANGLEY, SAMUEL P	1876	Feb. 27, 1906
LE CONTE, JOHN *	1878	Apr. 29, 1891
LE CONTE, JOHN L.*	....	Nov. 15, 1883
LE CONTE, JOSEPH*	1875	July 6, 1901
LEA, MATTHEW CAREY *	1892	Mar. 15, 1897
LEIDY, JOSEPH	....	Apr. 30, 1891
LESLEY, J. PETER	....	June 3, 1903
LESQUEREUX, LEO *	1864	Oct. 25, 1889
LONGSTRETH, MIERS F	....	Dec. 27, 1891
LOOMIS, ELIAS *	1873	Aug. 16, 1889
LOVERING, JOSEPH	1873	Jan. 18, 1892
LYMAN, THEODORE *	1872	Sept. 10, 1897
MAHAN, D. H.*	....	Sept. 16, 1871
MARSH, G. P.*	1866	July 23, 1882
MARSH, O. C	1874	Mar. 18, 1899
MAYER, ALFRED M	1872	July 13, 1897
MAYO-SMITH, RICHMOND	1890	Nov. 11, 1901
MEEK, F. B.*	1869	Dec. 21, 1877
MEIGS, M. C.*	1865	Jan. 2, 1892
MITCHELL, HENRY	1885	Dec. 1, 1902
MORGAN, LEWIS H.*	1875	Dec. 14, 1881
MORTON, HENRY	1874	May 9, 1902
NEWBERRY, J. S.*	....	Dec. 7, 1892
NEWTON, H. A.*	....	Aug. 1, 1896
NEWTON, JOHN*	1876	May 1, 1895
NORTON, WILLIAM A.*	1873	Sept. 21, 1883
OLIVER, JAMES E.*	1872	Mar. 27, 1895
PACKARD, A. S	1872	Feb. 14, 1905
PENFIELD, SAMUEL L.*	1900	Aug. 13, 1906
PETERS, C. H. F	1876	July 18, 1890
POURTALES, L. F.*	1873	July 19, 1880
POWELL, JOHN W	1880	Sept. 23, 1902
RODGERS, JOHN*	....	May 5, 1882
ROGERS, FAIRMAN*	....	Aug. 23, 1900
ROGERS, ROBERT E.*	....	Sept. 7, 1884
ROGERS, WM. A.*	1885	Mar. 1, 1898
ROGERS, WILLIAM B.*	....	May 30, 1882
ROOD, OGDEN N	1885	Nov. 12, 1902
ROWLAND, HENRY A.*	1881	Apr. 16, 1901
RUTHERFURD, LEWIS M.*	....	May 30, 1892
SAXTON, JOSEPH*	....	Oct. 26, 1873
SCHOTT, CHARLES A	1872	July 31, 1901
SELLERS, WILLIAM	1873	Jan. 24, 1905
SILLIMAN, BENJ., Sr.*	....	Nov. 24, 1864
SILLIMAN, BENJ., Jr	....	Jan. 14, 1885
SMITH, J. LAWRENCE*	1872	Oct. 12, 1883
STIMPSON, WILLIAM	1868	May 26, 1873
STRONG, THEODORE*	....	Feb. 1, 1869
SULLIVANT, W. S.*	1873	Apr. 30, 1882
TORREY, JOHN*	....	Mar. 10, 1873
TOTTEN, J. G.*	....	Apr. 22, 1864
TROWBRIDGE, WILLIAM P.*	1872	Aug. 12, 1892
TRUMBULL, JAMES H	1872	Aug. 5, 1897

* Biographical notices have been presented of those designated by an asterisk.

DECEASED MEMBERS—Continued.

	Date of election.	Date of death.
Tuckerman, Edward*	1868	Mar. 15, 1886
Walker, Francis A.*	1878	Jan. 5, 1897
Warren, G. K.*	1876	Aug. 8, 1882
Watson, James C.*	1868	Nov. 23, 1880
Watson, Sereno*	1889	Mar. 9, 1892
Winlock, Joseph*		June 11, 1875
Woodward, J. J.*	1873	Aug. 17, 1884
Worthen, A. H.*	1872	May 6, 1888
Wyman, Jeffries*		Sept. 4, 1874
Young, Charles A.	1872	Jan. 3, 1908

* Biographical notices have been presented of those designated by an asterisk.

DECEASED FOREIGN ASSOCIATES.

Sir Wm. Rowan Hamilton.
Karl Ernst Von Baer.
Henry Milne-Edwards.
Michael Faraday.
L. Elie de Beaumont.
Sir David Brewster.
G. A. A. Plana.
F. W. A. Argelander.
Friedrich Wöhler.
J. B. Dumas.
J. B. J. D. Boussingault.
M. E. Chevreul.
Michel Chasles.
Sir George B. Airy.
J. C. Adams.
Sir Richard Owen.
C. H. C. Burmeister.
Arthur Cayley.
T. H. Huxley.
Hugo Gyldén.
F. F. Tisserand.
Julius von Sachs.
Sir Roderick I. Murchison.
Victor Regnault.
H. W. Dove.
C. A. F. Peters.
Justus von Liebig.
Alexander Braun.
Joachim Barrande.
Adolphe Würtz.
Theodore von Oppolzer.
G. R. Kirchoff.
Rudolph Clausius.
James P. Joule.
Carlos Ibañez.
Jean Servais Stas.
Alphonse de Candolle.
A. W. Hofmann.
Baron H. von Helmholtz.
K. F. W. Ludwig.
Louis Pasteur.
August Kekulé.
Emil Du Bois Reymond.
J. J. Sylvester.
Karl Weierstrass.
Rudolph Leuckart.
C. F. Rammelsberg.
Sophus Lie.
Robert W. Bunsen.
J. L. F. Bertrand.
Henri de Lacaze-Duthiers.
Alfred Cornu.
Rudolph von Virchow.
Sir George G. Stokes.
Karl Gegenbaur.
Karl Alfred Ritter von Zittel.
E. J. Marey.
Otto von Struve.
F. von Richthofen.
Albert von Kölliker.
Ludwig Boltzmann.
M. P. E. Berthelot.
Henri Moissan.
D. I. Mendeleeff.
Maurice Loewy.
H. C. Vogel.
Lord Kelvin.
J. Janssen.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1908

WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1908

WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

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LETTER OF TRANSMITTAL.

National Academy of Sciences,
Office of the President,
Washington, D. C., February 10, 1909.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the year ending December 31, 1908.

Very respectfully,
Ira Remsen, *President.*

The President of the Senate.

ACT OF INCORPORATION.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AMENDMENTS.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said academy as provided in said act.

Approved, July 14, 1870.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1908 the academy held three sessions. The first was the regular annual session held at Washington April 21 to 23, inclusive; the second, a scientific session held at Baltimore November 17 and 18; the third, a special session held at Baltimore November 17 and 18 for the transaction of business.

ANNUAL MEETING.

BUSINESS SESSION.

The business meetings were held at the Smithsonian Institution, Washington, D. C., April 21–23, 1908.

The following members were present during the session: Messrs. Abbe, Abbot, Agassiz, Allen, Becker, Billings, Boss, Brewer, Cattell, Chamberlin, Dall, Dana, Davis, Emmons, Farlow, Gill, Hague, Hale, Hill, Holmes, Iddings, Mall, Mark, Merriam, Minot, Mitchell, Nichols, Noyes, Osborn, Peirce (B. O.), Remsen, Royce, Scott, Thomson, Walcott, Webster, Welch, Wells, White, Wilson, and Woodward.

REPORT OF THE HOME SECRETARY.

The President of the National Academy of Sciences.

Sir: I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 21, 1908.

The annual report of the president of the academy for the year 1907 was transmitted to the United States Senate February 1 through the courtesy of Senator George P. Wetmore, chairman of the Committee on the Library. The usual edition of 500 copies was received from the Government Printing Office March 6, 1908. Nearly one-half of the edition has been distributed to members of the academy, foreign associates, and such libraries and institutions as are on our domestic exchange list.

No scientific memoirs have been published during the past year. A paper by A. O. Leuschner entitled "Tables of minor planets discovered by James C. Watson," first series, is now ready for publication, and has been transmitted to the academy through Mr. Newcomb, chairman of the Watson fund, and will soon appear as the seventh memoir of Volume X.

The following biographical memoirs have been published during the year: Samuel L. Penfield, by Horace L. Wells; Joseph Le Conte, by Eugene W. Hilgard; Lewis Henry Morgan, by W. H. Holmes.

Messrs. Joseph P. Iddings, Franklin P. Mall, Harmon N. Morse, and Elihu Thomson were elected members of the academy at the annual meeting in April, 1907.

Two members have died since the last April meeting: Asaph Hall, on the 22d of November, 1907; and Charles A. Young, on the 3d of January, 1908. The academy has also lost by death four foreign associates: Lord Kelvin, Maurice Loewy, D. I. Mendeléeff, and H. C. Vogel. There are now 99 names on the membership list and 40 foreign associates.

Arnold Hague, *Home Secretary.*

April 21, 1908.

REPORT OF THE TREASURER.

The President of the National Academy of Sciences.

Sir: I have the honor to transmit herewith my report as treasurer of the National Academy of Sciences for the year ending April 21, 1908:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.	Gould fund.	Emmons and Gill trustees.	Building fund.	Comstock fund.
Receipts									
Balance brought forward:									
Cash	$806.20	$2,032.02	$891.21	$488.19	$951.94	$895.93		$331.63	
Invested income	4,500.00	4,000.00	155.94		250.43	1,500.00			
Interest	614.37	2,359.18	1,089.75	457.41	386.07	918.75	$620.00	67.50	$200.00
Members' tax	500.10								
Retransfer, Emmons and Gill account, April 19, 1899			319.29						
Temporary transfer from capital fund			72.71						
Total	6,420.67	8,391.20	2,528.90	945.60	1,588.44	3,314.68	620.00	399.13	200.00

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.	Gould fund.	Emmons and Gill trustees.	Building fund.	Comstock fund.
Disbursements and transfers.									
Disbursed	$835.13	$117.11	$2,528.90	$23.52	$223.92	$1,065.30	$152.85	$1.33	$1.32
Transfer to capital				511.41					
Transfer to Watson fund							319.29		
Balance:									
Cash	585.54	2,827.45		150.55	534.45	749.38	147.86	397.80	198.68
Invested income	5,000.00	5,446.64		260.12	830.07	1,500.00			
Total	6,420.67	8,391.20	2,528.90	945.60	1,588.44	3,314.68	620.00	399.13	200.00

Very respectfully,

S. F. Emmons, *Treasurer.*

April 21, 1908.

The treasurer's report was referred to an auditing committee composed of Messrs. Gill and Dall, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer; also that they have examined the securities and papers contained in the box of the academy at the American Security and Trust Company's building and have found them to correspond to the list furnished by the treasurer.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND.

(April, 1906–April, 1908.)

The following appropriations have been made:

September 30, 1906. Joseph S. Ames For the revision of Rowland's standard wave lengths.	$300
April, 1908. Joseph S. Ames For the revision of Rowland's standard wave lengths.	1,000
April, 1908. Gilbert N. Lewis To determine the free energy of formation of the important compounds of the alkali metals.	300

The vacancy in the board caused by the resignation of Dr. Henry P. Bowditch, who had served since 1902, has been filled by the election of Dr. Charles S. Minot.

Respectfully submitted.

S. C. Chandler.
Charles S. Minot.
Ira Remsen.

REPORT OF THE BOARD OF TRUSTEES OF THE WATSON FUND.

(April, 1908.)

In the absence of Professor Newcomb, chairman of this board, the undersigned reports that work upon tables of the small planets has been for some years the sole object to which our appropriations have been devoted. For several years Prof. Armin O. Leuschner, of the University of California, has been in charge of these computations. As will be seen further on, in a condensed statement of progress made by Professor Leuschner, the tables for twelve out of the twenty-two small planets discovered by Professor Watson have been computed and have been submitted to the academy for printing. Meanwhile, the available balance of income from the Watson fund has been exhausted. The Watson fund has accumulated in past years comparatively large sums which have been invested in interest-bearing securities for the benefit of income. Unless the academy chooses to sanction either the temporary or permanent use of a portion of this invested income the work on the Watson planets will have to be suspended for the present. In view of the capable and efficient manner in which this work has been carried on by Professor Leuschner, it seems desirable that some such action by the academy be taken.

SUMMARY OF PROGRESS.

I. Tables are being printed of the following twelve planets:

(93) Minerva.
(101) Helena.
(103) Hera.
(119) Althæa.
(105) Artemis.
(115) Thyra.
(128) Nemesis.
(133) Cyrene.
(139) Juewa.
(161) Athor.
(174) Phædra.
(179) Klytæmnestra.

II. The perturbations are developed, the observations collected, and the elements corrected for the following five planets:

(94) Aurora.
(100) Hekate.
(104) Clymene.
(121) Hermione.
(150) Nuwa.

A second correction of elements is necessary. The principal perturbations of the second order may have to be computed for some of these planets.

III. The perturbations are developed for one planet:

(79) Eurynome.

IV. Three planets belong to the group one-half, and special tables for this group have been computed after Boblin. A comparison of these tables with similar tables by Von Zeipel needs to be made before developing the perturbations. The original programme for these planets may be changed by adopting the Gylden-Brendel-Kramer method.

These planets are:

(106) Dione.
(168) Sybilla.
(175) Andromache.

V. One planet is lost. Computations are under way to decide its fate. The planet is (132) Æthra.

Total number of planets, 22.

Respectfully submitted.

LEWIS BOSS.

REPORT OF THE COMMITTEE ON THE J. LAWRENCE SMITH FUND.

(April, 1908.)

Dr. Oliver C. Farrington has received grants from the J. Lawrence Smith fund, amounting to $800, to provide clerical assistance in the preparation of a catalogue of the meteorites of North America. It had been hoped that the manuscript would be ready for the press this spring, but an unavoidable absence of the stenographer who has been employed on the matter has caused some delay. The committee has the manuscript of the introduction. The catalogue describes 245 meteorites, of which 162 are irons, 10 are iron-stones, and 73 are stones.

Respectfully submitted.

Edward W. Morley.

REPORT OF THE DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND.

(April, 1907–April, 1908.)

The following appropriation has been made:

January 4, 1908. Charles L. Doolittle $1,000
For the continuation of his investigation on the variation of latitude and the constant of aberration.

With sorrow the surviving directors have to record the death of their late associate, Prof. Asaph Hall. They wish also to place on record here the profound respect in which they have held him as a scientific man and the high esteem in which they cherish his memory as a friend endeared to them by long association.

Mr. G. W. Hill has been elected a member of the board to succeed Professor Hall.

Respectfully submitted.

Lewis Boss.
Seth C. Chandler.

COMMITTEE ON TRUST FUNDS AND COMMITTEES.

The council was requested to report the status of the several boards and committees in charge of the administration and awarding of the trust funds in charge of the academy. Their report on the trust funds will be found on pages 32–80.

COMMITTEE ON PLANS FOR MEETINGS.

Messrs. William M. Davis (chairman), Ira Remsen, G. E. Hale, A. A. Noyes, and H. F. Osborn were appointed a committee to consider plans for holding future meetings. On April 22, 1908, the committee presented their report to the academy, which favorably recommended it to the council for further consideration. (See p. 21.)

COMMITTEE ON INTERNATIONAL COOPERATION IN RESEARCH.

The academy approved the appointment of a committee on cooperation in research which should have the following duties:

(1) To keep in close touch with the work of the International Association of Academies, and to assist in securing suitable representation of the academy at the council and general meetings of the association.

(2) To consider plans for cooperation in research, and to recommend from time to time the initiation of such cooperative investigation as may warrant the support of the academy.

The following committee was appointed by the president: George E. Hale (chairman), Simon Newcomb, A. A. Noyes, H. F. Osborn, and C. S. Minot.

COMMITTEE ON INTERNATIONAL PALEONTOLOGIC CORRELATION.

Messrs. H. F. Osborn, W. B. Scott, C. D. Walcott, and W. H. Dall were appointed a committee on paleontologic correlation, and were given power to extend the membership of the committee so as to secure American and international cooperation.

ELECTION OF OFFICERS.

Mr. Samuel F. Emmons was reelected treasurer of the academy for a term of six years.

Messrs. W. H. Welch and E. B. Wilson were elected to serve as members of the council for three years.

ELECTION OF NEW MEMBERS.

Messrs. William B. Clark, Edwin G. Conklin, Whitman Cross, Simon Flexner, Edwin B. Frost, William F. Hillebrand, Ernest F. Nichols, Theobald Smith, and William E. Story were elected members of the academy.

ELECTION OF FOREIGN ASSOCIATES.

The following were elected foreign associates of the academy: S. A. Arrhenius, of Stockholm, Sweden; Charles Barrois, of Lille, France; Joseph Larmor, of Cambridge, England; Ivan Petrovic Pavlov, of St. Petersburg, Russia; and Hugo Ritter von Seeliger, of Munich, Germany.

SCIENTIFIC SESSION.

The scientific meetings were held in the National Museum, Washington, D. C., April 21–23, 1908. The following papers were presented:

A Proposed International Atlas of Land Forms. W. M. Davis.

The Geological Age of the Santa Cruz Beds of Patagonia with Restorations of Santa Cruz Mammals. W. B. Scott.

The Biological Station for Research, at Agars Island, Bermuda. E. L. Mark.

The Cytological Basis of Heredity and the Determination of Sex. E. B. Wilson.

On the Functions of the Parathyroid Glands in Their Relation to Calcium Mataholism and to Tetany. W. G. MacCallum and C. Voegtlin. (Introduced by W. H. Welch.)

Supplementary Atmospheres. T. C. Chamberlin.

Great Tangential Movements of the Earth's Crust. Bailey Willis. (Introduced by Ira Remsen.)

Some Results of the Magnetic Survey of the United States. L. A. Bauer. (Introduced by R. S. Woodward.)

The Metasilicates of Lime and Magnesia—An Application of Physical Chemistry to Minerals. E. T. Allen. (Introduced by R. S. Woodward.)

The Exact Measurements of Quantities of Heat, up to 1500° Centigrade. W. P. White. (Introduced by R. S. Woodward.)

Spermatogenesis in the Bee and in the Wasp. E. L. Mark and Manton Copeland.

Biographical Memoir of Alpheus Hyatt. W. K. Brooks.

Perceptions, Ideas, and Hallucinations. J. McK. Cattell.

Application of Periodic Solutions of the Problem of Three Bodies to the Motion of the Moon. F. R. Moulton. (Introduced by E. H. Moore.)

Biographical Memoir of Asaph Hall. G. W. Hill.

The Elevated Reefs of Mombasa and Adjacent Coast. A. Agassiz.

The Pelagic Fauna of Victoria Nyanza. A. Agassiz.

Recent Work of the Smithsonian Astrophysical Observatory. Charles Greeley Abbot. (Introduced by Charles D. Walcott.)

The Hydration of Ions in Solution. E. W. Washburn. (Presented by A. A. Noyes.)

Radiant of the Star-Group in Taurus. Lewis Boss.

AUTUMN MEETING.

SCIENTIFIC SESSION.

A scientific session called by the council for the reading of papers was held at Johns Hopkins University, Baltimore, Md., November 17 and 18, 1908.

The following members were present during the session: Messrs. Abbe, Barker, Becker, Billings, Brush, Cattell, Chamberlin, Chittenden, Clark, Conklin, Councilman, Cross, Dall, Emmons, Flexner, Gill, Hague, Hastings, Howell, Iddings, Mall, Morse (E. S.), Morse (H. N.), Nichols, Noyes, Osborn, Pupin, Remsen, Thomson, Van Hise. Walcott, Webster, Welch, and Woodward.

The following papers were presented:

The Close of the Cretaceous and Beginning of the Eocene in the Hell Creek Region of Montana. Based on Explorations of the American Museum between 1902 and 1908. Henry F. Osborn.

On the Distribution of Sound from the Megaphone, or Speaking Trumpet. A. G. Webster.

Elementary Species and the Effects of Selection in a Unicellular Organism. H. S. Jennings. (Introduced by Ira Remsen.)

Absorption Spectra of Mixtures of Metallic Vapors. R. W. Wood. (Introduced by Ira Remsen.)

The Mercury Paraboloid as a Reflecting Telescope. R. W. Wood. (Introduced by Ira Remsen.)

Results Obtained in the Direct Measurement of Osmotic Pressure. H. N. Morse.

Certain Examples of Biochemical Control of Cell Development. Simon Flexner.

(*a*) Metaplasia of Transplantable Tumors.

(*b*) Inhibition of Spirocheta Pallida.

Further Studies on the Effect of a Low Protein Diet on High Protein Animals. Russell H. Chittenden.

The Echini of an Insular Fauna. A. Agassiz and H. L. Clark.

The Work of the United States Fish Commission Ship *Albatross*. Alexander Agassiz.

The Absorption Spectra of Solutions of Certain Salts. H. C. Jones and John A. Anderson. (Introduced by Ira Remsen.)

The Reactions of Primates to Monochromatic Lights. John B. Watson. (Introduced by Ira Remsen.)

Effects of Centrifugal Force on the Organization and Development of the Eggs of Certain Animals. E. G. Conklin.

The Phosphates of the Soil. C. R. Van Hise.

Biographical Memoir of Joseph Lovering. B. O. Peirce.

Biographical Memoir of William M. Gabb. W. H. Dall.

BUSINESS SESSION.

The business meetings were held at Johns Hopkins University, Baltimore, Md., November 17 and 18, 1908.

COMMITTEE ON CONDUCT OF SCIENTIFIC WORK.

The academy approved the action of the president in appointing a committee consisting of Messrs. R. S. Woodward (chairman), C. R. Van Hise, W. W. Campbell, E. L. Nichols, and A. A. Noyes to investigate the organization of the scientific bureaus of the United States Government, as directed by the following paragraph in the sundry civil act approved May 27, 1908:

> SEC. 8. The National Academy of Sciences is required, at their next meeting, to take into consideration the methods and expenses of conducting all surveys of a scientific character, also all chemical, testing, and experimental laboratories, and to report to Congress as soon thereafter as may be practicable a plan for consolidating such surveys, chemical, testing, and experimental laboratories so as to effectually prevent duplication of work and reduce expenditures without detriment to the public service.
>
> It is the judgment of Congress that any person who holds employment under the United States, or who is employed by and receives a regular salary from any scientific bureau or institution that is required to report to Congress, should refrain from participation in the deliberations of said National Academy of Sciences on this subject and from voting on or joining in any recommendation hereunder.

The report of this committee will be found on pages 27–31.

COMMITTEE ON CONSERVATION OF NATURAL RESOURCES.

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The president was authorized to appoint a committee of three to cooperate with the National Commission on the Conservation of Natural Resources. He accordingly appointed Messrs. William B. Clark (chairman), William M. Davis, and Edwin G. Conklin members of the committee.

APPOINTMENT OF DELEGATE.

Mr. William Trelease was appointed a delegate to represent the academy at the inauguration of Albert Ross Hill as president of the University of Missouri, at Columbia, Mo.

DEATHS DURING 1908.

William K. Brooks died on the 12th of November and Wolcott Gibbs on the 9th of December, 1908.

Henri Becquerel, a foreign associate, died on the 25th of August, 1908.

SHORT BIOGRAPHY OF WOLCOTT GIBBS.

Wolcott Gibbs was one of the charter members of the academy, the last to survive. He was president of the academy from 1895 to 1901. He was born in New York City February 21, 1822, and was therefore in the eighty-seventh year of his age. His long life was devoted to the cause of research in the field of pure science, and his influence was always on the side of the highest ideals. He was a foreign member of the London Chemical Society and an honorary member of the German Chemical Society, the only American upon whom the latter honor has been conferred.

Doctor Gibbs received his early education at the grammar school attached to Columbia College, and was then graduated from the college in 1841. He evidently had a bent toward chemistry in his early life, for after graduating from college he spent a few months in the laboratory of Dr. Robert Hare, in Philadelphia. He then returned to New York and studied medicine, receiving the degree of doctor of medicine from the College of Physicians and Surgeons in 1845. He spent a year and a half working in the laboratories of Rammelsberg and Heinrich Rose, in Berlin. He was for some time at Giessen under Liebig, and then attended Regnault's lectures on physics at the College of France. From 1849 to 1863 he was professor of physics and chemistry in the College of the City of New York, when he was elected to the Rumford professorship in Harvard College, and was placed in charge of the laboratory of the Lawrence Scientific School. This position he held for twenty-four years. Since then he has been professor emeritus, living at Newport, R. I.

He has published elaborate memoirs on the platinum metals, on the ammonia-cobalt bases, on new analytical methods, and on complex inorganic acids, discovering platino-tungstates, vanadio-tungstates, vanadio-molybdates, etc. In physics he has published papers on wave-lengths of light, on vapor densities, improved methods of gas analysis, and on the theory of the dynamo.

SHORT BIOGRAPHY OF WILLIAM K. BROOKS.

William Keith Brooks was born March 25, 1848, in Cleveland, Ohio. He was educated at Harvard University and Williams College, receiving the degree of bachelor of arts from the latter in 1870. After studying zoology at Harvard, at the Boston Museum of Natural History, and at the laboratory of Alexander Agassiz at Newport, he received the degree of doctor of philosophy from Harvard in 1875. In 1876 he was appointed fellow of the Johns Hopkins University, but before entering upon the fellowship he received an appointment as a member of the teaching staff of the university. Subsequently, as director of the Chesapeake Zoological Laboratory, 1878 to 1898, as professor of morphology, and then as Henry Walters professor of zoology, his life was spent in the work of the university until his death, November 12, 1908. Professor Brooks was chairman of the oyster commission of Maryland from 1882 to 1884. His contributions to science were not only observations of facts that bore upon the dominant theory of evolution, but were creative interpretations, and culminated in the essays that strove to express the mature attitude of his mind toward the fundamental problems of nature.

THE PROTECTION AND UTILIZATION OF THE APPALACHIAN AND WHITE MOUNTAINS NATIONAL FORESTS.

At a meeting of the council of the National Academy of Sciences held in January, 1908, the following resolutions were adopted and forwarded to the United States Senate and the House of Representatives:

Whereas under the present drain upon the forest the timber supply of the entire United States will be exhausted within twenty years, while in the Eastern States, where no adequate means have been employed to protect the forest, the end of the supply is even nearer;

Whereas the headwaters of all important navigable streams to the west of the Mississippi River are now protected by national forests, while the Appalachian Mountains, which form the watersheds of many navigable streams of great importance, are entirely unprotected and are being damaged to a menacing extent by the wasteful cutting of the forest, unrestricted fires, and injudicious clearing:

Resolved, That the council of the National Academy of Sciences heartily favors the extension of the national forest system to the Appalachian Mountains for their protection and permanent utilization.

Resolved, That we urge upon Congress the passage at the present session of a bill to acquire in the southern Appalachian Mountains and the White Mountains such forest lands as are necessary to protect the navigable streams which have their sources therein and to make permanent the timber supply of the eastern part of the United States.

REPORT OF COMMITTEE ON PLANS FOR MEETINGS.[a]

The committee appointed at the annual meeting in April, 1908, to consider plans for holding future meetings made the following report:

The propositions and plans may be grouped under four headings: First, a general statement of ideals to be attained; second, responsibilities of members in the attainment of these ideals; third, action recommended for the council; and, fourth, action recommended for the local committee of arrangements.

Especial attention is asked to the recommendations of headings 3 and 4, because of their practicable nature. It is hoped that the objects noted in the first and second headings may eventually be realized as results of action recommended in the third and fourth headings.

First. The public meetings of the academy should become important scientific events, attracting a significant attendance of scientific men and of the interested public. The meetings should be partly occupied with addresses of a broad and generally intelligible nature, prepared upon special invitation by designated members or committees of the academy or by scientists who are not members. The addresses should treat the recent advances and the present state of knowledge relating to important topics in the various branches of science; and should include topics of international cooperation and reports on research in laboratories, such as those of the Carnegie Institution, of universities, and of governmental bureaus. Opportunity should also be open for papers presented by members on their own initiative, but highly specialized papers presented in such a manner as to be intelligible or of interest to but few members should be discouraged. The meetings should promote the general interests of science and of scientific research in the United States and should encourage international scientific cooperation, especially through the Association of Academies of which the National Academy is a member. Exhibits of new scientific apparatus, specimens, etc., illustrating work in progress or recently completed, should be encouraged. Visits to scientific establishments should be arranged.

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[a] At a meeting of the council, on November 17, 1908, it was decided, after discussion, that such of the changes and recommendations in this report as were deemed advisable could best be accomplished through local committees, because of the fact that the conditions and needs vary with the time and place of the meetings.

Second. The attainment of some of the above objects will demand the hearty interest and support of all members of the academy, and will from time to time involve certain members in the extra work (apart from their usual duties) of preparing summaries in their special branch of science; and of acting as members of the local committee of arrangements.

The following recommendations are designed to bring about the objects mentioned under the first heading.

Third. It is recommended that the council (1) prepare a general statement, indicating the plan of designated addresses on various branches of science, as noted above; and emphasizing the desirability of preparing generally intelligible and interesting addresses and papers, as well as the importance of careful selection when inviting nonmembers to present communications; (2) give full authority to the committee of arrangements to arrange the programmes for the best interests of the meetings, irrespective of the order in which titles are received; (3) prepare a blank on which a member who presents a communication shall be invited to indicate its character, so that the committee of arrangements may act intelligently in assigning it a place on the programme; (4) if the plan of having designated addresses is adopted, the council should ordinarily designate at each meeting the subjects of addresses and the members who are to prepare them for the meeting a year later; and (5) if the following or some similar plan is adopted for the general guidance of the local commitee of arrangements it should be printed by the council and sent to the chairman of the committee on his appointment.

Fourth. It is recommended (1) that the committee of arrangements should be appointed at least three months before the date of the meeting which it is to supervise; (2) that it should promptly outline the plans for the meeting and report them to the home secretary; (3) that the home secretary should, not less than two months before the meeting, send to all members a brief circular, announcing such plans as have then been reported by the committee of arrangements, stating the subjects and authors of any designated addresses, inviting members to send to the chairman of the local committee of arrangements the titles of communications (on blanks, as above), and if an exhibit is planned, to indicate the objects that they will show; and stating the date on which the provisional programme will be printed; (4) that not less than two weeks (better, three weeks) before the meeting the committee of arrangements should issue a provisional programme, giving a list of addresses and speakers, and of papers offered, and detailing plans for the meeting (business sessions, scientific sessions, exhibits, visits, dinners, etc.); and (5) that the final programme should be ready for distribution at the opening of the meeting.

The following recommendations are also offered:

Business sessions should be given ample time for due deliberation, but should not be continued after the hour at which a public scientific session has been announced. It is suggested that half a day, either the second morning or the first afternoon, should be devoted to the business session; or that, if two or more sessions are needed, they should be so placed as not to be directly followed by a scientific session, in order that the final business of the meeting may be completed without undue haste.

Scientific sessions.—The committee of arrangements should actively concern itself with securing representative communications of general intelligibility by local members and their invited colleagues. A meeting should ordinarily last three days, and a programme containing more communications than can be presented in full in a three-days' meeting should be the normal exception. The committee of arrangements should, under the authority given by the council, arrange the programme for the best interests of all concerned in the meeting, placing the designated addresses and such papers as appear to be of most general interest in the best hours, and not necessarily placing all papers of one science together, because if papers are made more generally intelligible, the need of grouping by subjects is decreased. While those who have been invited to prepare addresses should surely be given full hearing, all others should willingly accept the decision of the committee of arrangements as to their places on the programme, as to time allowance, or even as to the need of reading their papers by title only. In courteous consideration of the invited public, the public sessions should be opened promptly at the hour announced.

Exhibits and visits.—At every autumn meeting, and at every third or fourth Washington meeting, an exhibit should, if possible, be prepared for the first or second afternoon of the meeting. Objects exhibited should preferably represent work upon which members and invited exhibitors are actually or have been recently engaged, so that the preparation of exhibits shall require as little special work as possible. A list of exhibits should be printed; it should be distributed in provisional form with the provisional programme. At Washington, when no exhibit is prepared, an afternoon visit by members of the academy to some scientific bureau is recommended.

Public announcement.—Besides general public announcement of the meetings in local newspapers, special cards of invitation, indicating the place and hour of public sessions and exhibits and accompanied by the (provisional) programme of the meeting, might be appropriately sent to a good number of local scientists and to others likely to be interested in the meeting.

Social gatherings.—Especial care should be taken to provide several occasions when the members of the academy and their invited guests may meet one another informally. For this purpose, at least an hour and a half should be allowed for lunch each day; each member should pay for himself and for any out-of-town guests he may bring; the committee of arrangements may pay for local guests. If an afternoon visit is made to a scientific bureau, it may be desirable that the lunch should be served at the bureau visited.

Informal suggestions.—An academy dinner should be planned for one of the evenings, preferably the first; it should be simple and inexpensive; each member to pay for himself, the committee of arrangements to pay for local guests. It is held to be desirable that outside invitations to these evening gatherings should be closely limited, so as to give the members good opportunity of seeing one another.

William M. Davis,
Chairman.

Ira Remsen.
G. E. Hale.
A. A. Noyes.
H. F. Osborn.

REPORT OF COMMITTEE ON SEMICENTENNIAL VOLUME.

The committee on the semicentennial volume, appointed November 20, 1907, presented the following report, dated April 18, 1908:

The committee to whom was referred the question of the advisability of publishing a memorial volume commemorative of the semicentennial of the National Academy of Sciences in April, 1913, together with an estimate of the cost of such a work, presents the following report:

The members of the committee believe it to be eminently fitting that such a volume should be issued, and that a committee should be appointed to take charge of its preparation and publication.

As regards the scope of such a volume, much would depend on the funds that could be provided to meet its cost. In order to bring the matter before the academy for discussion, the committee offers the following suggestions:

First. A chapter on the early history of the academy, the influences which led up to its organization during the early years of the civil war, the methods employed in the selection of the 50 incorporators, the framing of the act of incorporation and its passage by Congress, and the history of its early organization after the action of Congress. With one exception[a] all the founders of the academy have passed away, and of those who were elected to membership during the following five years the names of only a small number remain upon the rolls; hence at the present time the academy has but limited means of gathering first hand authentic records of its early history from those who took part in it, although such information might be obtained readily.

Second. A chapter presenting the relations of the academy to the National Government and the influences which led up to the clause in the act of incorporation clearly defining this relationship. The academy has in times past been consulted by different executive branches of the Government, and advice has been given on many scientific matters, much of which when adopted has been of great practical value. The academy has no concise record of the work accomplished on these lines.

Third. Since the foundation of the academy the relations of the General Government toward science have been greatly modified, and the question arises, What means can be taken, if any, to increase the influence of the academy in scientific matters and to bring about any needed reforms and changes in the methods of administration of scientific work?

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[a] Now without exception, due to the death on December 9, 1908, of Mr. Wolcott Gibbs.

Fourth. An account showing what has been accomplished with the incomes derived from the academy trust funds. Each year bare statements are announced of allotments in aid of research, and unquestionably work of high value has been done. Probably no single member of the academy fully realizes the results of these labors, as the work has never been brought together in readable form.

Fifth. The publications of the academy. It is said that no complete bibliography of such publications has ever been printed, and it is very doubtful if such a list could be prepared. The records of the academy in the early days of its existence are very imperfect. The academy has no complete set, even of its annual reports. Apparently there were years when no reports were issued.

Sixth. The academy bestows medals for eminent services to science, from funds provided for by the Henry Draper and Lawrence Smith trusts, and recommends to Columbia University the individual upon whom shall be conferred the honor of receiving the Barnard medal. A short chapter should bring together the names of those selected for these honors, accompanied by a statement why such selections were made, based upon their original investigations and services to science.

The committee suggests that certain members of the academy be selected to write chapters, giving an account of advances made in each science during the half century since the foundation of the academy, dwelling especially on the part contributed by America in the progress of these sciences. The members of the academy have done much in bringing about these results. It is further suggested that it would be a most appropriate memorial to reproduce a likeness of all founders, together with a short biographical sketch of each, say three or four such notices to the page.

Your committee believes that the volume should not exceed 500 pages, and should be artistically but not elaborately illustrated; that an edition of 700 copies would meet the requirements of the academy. It is estimated that the cost of printing and binding such a book would be about $2,000. The employment of an editor, clerical services, and incidental expenses would amount to $2,500 additional—in all, say, from $4,500 to $5,000.

The committee recommends that if the preparation of the memorial be authorized by the academy, a permanent committee be appointed to begin the collection of the necessary material without delay, in order that the volume be ready for distribution on the occasion of the semicentennial celebration.

Arnold Hague,
Chairman.
Chas. D. Walcott.
R. S. Woodward.
J. McK. Cattell.
Edw. S. Morse.

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CONDUCT OF SCIENTIFIC WORK UNDER UNITED STATES GOVERNMENT.

The report of the committee of the National Academy of Sciences, appointed at the April meeting to consider certain questions relating to the conduct of the scientific work under the United States Government, was transmitted to Congress on January 18, 1909, as a message from the President of the United States. The letters of transmittal and the report of the committee follow:

LETTER OF TRANSMITTAL FROM THE PRESIDENT OF THE UNITED STATES.

To the Senate and House of Representatives:

In compliance with the provisions of section 8 of the act of Congress making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1909, approved May 27, 1908, I transmit herewith for the consideration of the Congress the report of the National Academy of Sciences relating to the conduct of the scientific work under the United States Government.

THEODORE ROOSEVELT.

THE WHITE HOUSE,
January 18, 1909.

LETTER OF TRANSMITTAL FROM THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

NATIONAL ACADEMY OF SCIENCES,
OFFICE OF THE PRESIDENT,
Baltimore, January 16, 1909.

SIR: The sundry civil act approved May 27, 1908, requests the National Academy of Sciences to consider certain questions relating to the conduct of the scientific work under the United States Government, and to report the result of its investigations to Congress.

Immediately after the passage of the act a committee, consisting of five eminent men of science, none of whom held employment under the United States Government, was appointed to make the necessary investigation. The members of that committee are:

R. S. Woodward, president of the Carnegie Institution of Washington, chairman.
W. W. Campbell, director of the Lick Observatory, Mount Hamilton, Cal.
Edward L. Nichols, professor of physics, Cornell University.
Arthur A. Noyes, acting president of the Massachusetts Institute of Technology.
Charles R. Van Hise, president of the University of Wisconsin.

Under date of January 9, 1909, this committee submitted its report to the council of the academy.

I have the honor to transmit herewith this report to Congress.

I am, sir, very respectfully,

IRA REMSEN.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

REPORT OF COMMITTEE ON CONDUCT OF SCIENTIFIC WORK UNDER THE UNITED STATES GOVERNMENT.

To the Council of the National Academy of Sciences:

During the first session of the Sixtieth Congress of the United States there was incorporated in the act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1909, the following section, namely:

> SEC. 8. The National Academy of Sciences is required, at their next meeting, to take into consideration the methods and expenses of conducting all surveys of a scientific character and all chemical, testing, and experimental laboratories and to report to Congress as soon thereafter as may be practicable a plan for consolidating such surveys, chemical, testing, and experimental laboratories, so as to effectually prevent duplication of work and reduce expenditures without detriment to the public service.
>
> It is the judgment of Congress that any person who holds employment under the United States, or who is employed by and receives a regular salary from any scientific bureau or institution that is required to report to Congress, should refrain from participation in the deliberations of said National Academy of Sciences on this subject and from voting on or joining in any recommendation hereunder.

In compliance with the terms of this legislation, the president of the National Academy of Sciences appointed the undersigned committee to consider the questions specified in said legislation, with a view of securing a report on or before the next annual meeting of the academy. This committee now has the honor to submit a report.

It should be explained, first, that in compliance with a request addressed by the president of the academy to the President of the United States, all of the executive departments of the Government were directed to assist the representatives of the National Academy of Sciences in securing such information as might be necessary in preparing this report. The communication from the President of the United States announcing that such direction had been issued bears the date June 29, 1908. In conformity therewith numerous communications have been received by your committee from heads of departments and from bureaus and divisions of the Government engaged in the kinds of work specified in the legislative act cited above.

In the second place, it should be stated that this committee has had access to the unpublished preliminary report of a committee appointed by the President of the United States March 13, 1903, to consider many of the same questions here reported upon and others closely allied thereto. The chairman of the latter committee has also placed at our disposal a large mass of data collected by that committee.

In the third place, it should be stated that the members of your committee have been chosen in strict conformity with the requirements of the second paragraph of the legislative act quoted above.

A comprehensive interpretation of the functions of your committee shows that the field work for consideration is very large, and that it presents many difficulties requiring the most careful study before any final recommendations for legislative or executive action may be safely made. Nearly every department of the Government is involved to a greater or less extent, while some departments, like the Department of Agriculture and that of Commerce and Labor, are carrying on scientific work in a great variety of ways. Thus, to illustrate the extent and variety of this work, it may be stated that surveys are now being carried on by seven different organizations under five different departments of the Government; similarly, tests of apparatus, materials, foods, etc., are being made by the Bureau of Standards, by the technologic branch of the Geological Survey, by the Department of Agriculture, and to a minor degree by many other departments and bureaus of the Government. Similarly, chemical work is carried on in many branches of the Department of Agriculture, by the Bureau of Standards, by the Geological Survey, by the Public Health and Marine-Hospital Service, and to a less extent by other branches of the public service.

It should be borne in mind also, in considering the present status of these organizations carrying on scientific work, that many of them have been so long established as to become integral parts of the departments to which they are assigned. Hence, any considerations looking to a consolidation or to a redistribution in the departments of these organizations should take into account their origin and historical development as well as their present status. The experience gained through a long series of years by these organizations should

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indicate what special merits they possess as well as the defects of organization and efficiency they may now present.

In view, therefore, of the importance of the scientific work now carried on by the Government, and in view of the certain prospect that it will increase rather than decrease in the future, your committee is disposed to look at the problems presented by this work with a desire rather to furnish constructive criticism and advice than to recommend any immediate and radical changes based on destructive criticism, however well founded the latter may be in some cases. In other words, it appears more important to your committee to provide for enlightened and efficient conduct of governmental scientific work in the future than to be influenced to any considerable degree by the imperfections of organization and the inefficiencies in conduct of that work in the past.

From a general survey of the field of work under consideration three facts appear to be clearly established, namely:

First. That the amount of actual duplication of work now carried on by the government bureaus is relatively unimportant; but that the duplication of organizations and of plants for the conduct of such work is so considerable as to need careful attention from Congress in the future.

Second. That while the consolidation of some branches of work now carried on in several organizations is probably advisable, specific recommendations in reference to such consolidation can be made wisely only after a careful consideration of all the facts by the board hereinafter suggested or by some similarly competent body.

Third. That there has never been hitherto and there is not at present anything like a rational correlation of allied branches of scientific work carried on by the Government.

This last fact appears to your committee by far the most important one presented for consideration. The lack of any well-defined plan for the development of such work, its distribution in various departments, and the lack of any systematic scheme of interrelations of the bureaus carrying on this work have led inevitably and properly to the questions submitted by Congress to the academy.

It is plainly desirable, therefore, that Congress should make immediate provision to guard against a continuance of the evils which arise from a lack of any definite plan for, and from the absence of any adequate correlation of, the scientific work of the Government.

It appears to your committee that the best way to deal with the condition now confronting the Government is to secure the appointment by Congress of a permanent board which shall meet at stated intervals in each year for the consideration of all questions of the inauguration, the continuance, and the interrelations of the various branches of governmental scientific work. We would suggest that such a board should consist of the heads of bureaus carrying on scientific work, of two delegates from each of the Houses of Congress, and of five to seven eminent men of science not connected with the government service.

By means of a few meetings per year, with authorization to secure the requisite information from the heads of departments and bureaus concerned, all of the complicated questions which now are at best only ill considered could be carefully determined with great advantage in point of economy and efficiency to the public service and with little or no additional expense thereto.

Such a board could take under consideration the prevailing lack of system and lack of correlation in the work in question and gradually remove these defects from existing bureaus and divisions of the public service. All questions of the assignment, of the conduct, of advisable consolidation, and of the economies of such work could be fully discussed and determined in the best interests of the Government by such a board. If the heads of bureaus and divisions were required to submit their projects and estimates for work to this board before transmission to the heads of departments and to Congress, all questions of the duplication of work, of the duplication of organizations, of the duplication of laboratories or equipments, and of the most economical assignment could be readily determined without interference in the details of management of the organizations concerned.

One of the most important functions of such a board should be that of the nomination or selection of men competent to take charge of new projects or to fill vacancies which may arise in the more important positions of the scientific work in question. It would thus be generally possible to prevent the assignment of an incompetent man to the charge of a highly technical or specialized branch of the public service. It would thus be possible also to secure men of the highest professional attainments and to prevent the calamity which has not infrequently occurred in the past of assigning important scientific work to unprofessional or incompetent men. It would thus be possible likewise to take advantage of the competition between different branches of the public service in the laudable desire of those branches to prove their efficiency by the accomplishment of the required work of the Government in the best and most economical ways.

Very respectfully submitted.

R. S. Woodward,
Chairman.
W. W. Campbell.
Edward L. Nichols.
Arthur A. Noyes.
Charles R. Van Hise.

Washington, D. C., *January 9, 1909.*

REPORT ON TRUST FUNDS OF THE NATIONAL ACADEMY OF SCIENCES.[a]

GENERAL STATEMENT.

The constitution as amended and adopted April 17, 1872, and further amended at various subsequent meetings, provides as follows for the care of trust funds:

> Article V, section 7: * * * Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.
>
> Article VI, section 1: Of the property of the academy.—All investments shall be made by the treasurer in the corporate name of the academy, in stocks of the United States or, with the approval of the council, in state bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the academy.

The academy receives its authority for the care of such funds by an act of Congress "to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes," approved June 20, 1884:

> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said academy in aid of scientific investigations and according to the will of the donors.

The capital of the various trust funds administered by the National Academy of Sciences is as follows:

A. D. Bache fund	$52, 286. 00
Joseph Henry fund [b]	40, 000. 00
J. C. Watson fund	25, 000. 00
Henry Draper fund	10, 000. 00
J. Lawrence Smith fund	10, 000. 00
Wolcott Gibbs fund	2, 673. 17
B. A. Gould fund	20, 000. 00
C. B. Comstock fund	10, 400. 00

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[a] With the exception of the will of Nancy Clarke Bache, page 34, all the instruments quoted in the following pages have been compared with the originals, and are exact copies.

[b] According to the terms of the deed of gift, this amount is not yet available. (See p. 50.)

THE A. D. BACHE FUND.

The will of Alexander Dallas Bache, dated March 18, 1862, contains the following provisions:

Item.—As to all the rest and residue of my Estate, including the sum of Five thousand dollars placed at the disposal of my wife in case she should not desire to make any disposition of the same, I direct my executors hereinafter named to apply the income thereof after the death of my wife according to and under the directions of Joseph Henry of Washington, Louis Agassiz and Benjamin Peirce of Harvard College, Massachusetts, to the prosecution of researches in Physical and Natural Science by assisting experimentalists and observers in such manner and in such sums as shall be agreed upon by the three above-named gentlemen, or any two of them, whom I constitute a Board of Direction for the application of the income of my residuary estate for the above objects, after the death of my said wife. The class of subjects to be selected by this Board, and the results of such observations and experiments, to be published at the expense of my Trust Estate under their direction out of the income thereof but without encroaching on the principal.

In case of the death or inability to act of all or any of the three gentlemen I have named in my wife's lifetime, My will is that she shall supply their places in the Board of Direction by an Instrument of writing either testamentary or otherwise, desiring that in the selection of the persons, to administer the income of the trust funds hereby created, she will have regard to the selection of persons whose attention has been directed to the same branches of science as those I have named and so that each of the Departments of Physics, Mathematics, and Natural History shall be represented in the Board. In case of any vacancy occurring in the Board of Direction after its organization and after the death of my wife, by reason of the death inability or refusal to act or resignation of any of its members, my will is that the surviving or remaining member or members for the time being shall have power to fill vacancies so occurring in the Board by the selection of other person or persons to fill such vacancies and so on from time to time as vacancies shall occur. My intention being that the Board of Direction shall have power to continue its existence and to filling all vacancies occurring in their body from time to time I direct that a minute of their proceedings be kept, and that the appointment of any member by the Board shall be notified in writing to the trustees for the time being of my residuary estate. In the event of any failure of the Board for the time being to direct the application of the income of my said residuary estate, or to continue its existence by filling vacancies occurring in their body, my will is that the application of the income thereof for the purposes and objects declared in this clause of my Will, shall be made by the Trustees, under the direction of The American Philosophical Society of Philadelphia.

* * * * * * *

Item.—I hereby nominate and appoint my friends, Peter McCall, Esq., and Morton P. Henry, Esq., of the City of Philadelphia, and the survivor of them, to be the executors of and trustees under this my last will and Testament.

CODICIL, JULY 15, 1863.

Item.—I give and devise to my sister Sally Franklin Wainwright the house purchased by me situated No. 398 West Twentieth Street, in the City of Washington, between G and H Streets to be held and enjoyed by her during the term of her natural life. After her death I direct the said house shall pass with the residue of my Estate (subject to a life estate of my wife Nancy Clarke Bache therein in case she should survive my sister) to The National Academy of Sciences, upon the Trusts set forth as to the said residue of my estate.

* * * * * * *

Item.—My will is that upon the death of my wife all the rest and residue of my Estate shall be paid over to and vest in the corporation of The National Academy of Sciences incorporated by Act of Congress, passed the Third day of March, A. D. 1863, whom I hereby appoint Trustees in the place of my said Executors under the Fourth clause of my said will to apply the income according to the directions in the said clause contained to the prosecution of researches in Physical and Natural Science by assisting experimentalists and observers in such manner and in such sums as shall be agreed upon by the Board of Direction in the said clause named. My will further is that in case of any failure of the Board for the time being to direct the application of the income of my residuary estate or to continue its existence by filling vacancies occurring in their body, the application of the income thereof for the purposes and objects declared in the said clause shall be made under the Direction of The National Academy of Sciences instead of The American Philosophical Society of Philadelphia. In all other respects the said application of the income to the purposes aforesaid to be made by the same persons and under the same rules as I have prescribed in the said clause of my will.

Duly sworn to before Saml. Lloyd, February 27, 1867, in the city and county of Philadelphia.

STATED SESSION, APRIL 13-17, 1870.

The treasurer, Mr. Fairman Rogers, reported that by the death, in February, 1870, of Mrs. Bache the property of Prof. A. D. Bache passes to the National Academy of Sciences, and he was given full power, by a vote of the academy, to receive the trust fund and to act as attorney in fact for the academy in all matters pertaining thereto.

The last will and testament of Nancy Clarke Bache is as follows:

I hereby, in pursuance and exercise of the power of appointment contained in the last will and testament of my husband, Alexander Dallas Bache, devise, bequeath, and appoint the sum of five thousand dollars of the principal of the estate of my said husband, over which I have a power of appointment by his will, to be paid by his executors, or by such person or persons as shall hold the principal of the estate at my death, to my nephew, Henry Wood Bache, absolutely; and I hereby request my nephew, in case he should die unmarried and without issue, to make such a disposition of this amount by will as will secure it to be paid at his death to the National Academy of Sciences, at Washington, to be held by that corporation upon the same trusts and for the same purposes as are declared by my husband in his will as to the residue of his estate after my death. I expressly desire, however, that it shall be understood that this request shall not be construed into any direction which would interfere with his full control of the principal, which is to be paid into his hands directly.

Second. I hereby direct the house, No. 1624 Chestnut street, in which I now reside, to be sold by my executor, hereinafter named, within a reasonable time after my death, either at public or private sale, and after deducting from the purchase money any debts or expenses connected with the sale and the administration of my estate, which, with the cash on hand or other property which I may own or possess at my death, shall be sufficient to satisfy, I direct my executor to pay over the net proceeds to the National Academy of Sciences, at Washington, to be held by that corporation as trustees in trust to apply the income thereof to the prosecution of researches in physical and natural science, according to the directions contained in the last will and testament of my husband as to the residue of his estate after my death in the same manner as if all the directions contained in the last will and testament of my husband and in the codicil thereto were herein repeated at length; my object being to make precisely the same disposition of the proceeds of this house as was made by my husband of his residuary estate after my death.

Third. I direct all the medals and diplomas of my husband, and the large photograph of him now in my possession, to be deposited and remain with the National Academy of Sciences. I have made a memorandum of the disposition of certain other articles, which I desire shall be carried into effect as if contained in this will. I appoint Morton P. Henry, of Philadelphia, executor of this my last will and testament.

CODICIL, APRIL 19, 1869.

Item.—I hereby direct my executor to pay out of the proceeds of the sale of my said house, No. 1624 Chestnut street, Philadelphia, which I have directed to be sold, the sum of five hundred dollars to my nephew, Henry Wood Bache, for his own use and benefit. I further direct my executor to invest five thousand dollars of the proceeds of sale of said house in his own name as trustee in such securities as he may think proper, and to pay the income thereof to my nephew, Henry Wood Bache, during his natural life. After the death of my nephew, I direct that the principal of the said sum of five thousand dollars shall go to the National Academy of Sciences, at Washington, in trust for the same uses and purposes as are declared as to the proceeds of sale of said house by my said will. I expressly declare that the above bequests to Henry Wood Bache are in addition to the five thousand dollars I have appointed to him out of my husband's estate.

Item.—I hereby declare that the balance of the proceeds of the sale of my said house shall go, after paying and providing for the above legacies, as is set forth and declared in my said will, which in all other respects I hereby republish and declare as my last will and testament.

Sworn and subscribed before John Campbell, deputy register, in the city and county of Philadelphia, January 20, 1870.

STATED SESSION, APRIL 18–23, 1871.

The treasurer announced that the proceeds of the estate left to the academy by the late Prof. A. D. Bache had been formally handed over to him by the executors; that it amounted to $40,515.07, together with an annual ground rent of $102, and some land in Missouri not now available; and that in conformity with resolutions adopted by the academy he was converting the securities into United States bonds as soon as practicable, and had given bonds in the sum of $50,000.

STATED SESSION, APRIL 16-19, 1872.

The treasurer made a financial report, and stated that the annual income amounted at present to about $2,500 in gold. He presented his bond to the academy, which was approved and placed in the custody of the President.

STATED SESSION, APRIL 21-25, 1874.

The president, secretary, and treasurer of the academy were authorized to expend a sum of money not exceeding $200 in repairing and properly protecting the Bache monument in the Congressional Cemetery, Washington, D. C.

STATED SESSION, APRIL 18-22, 1876.

A resolution was adopted by the academy authorizing the sale of the Foran ground rent, part of the assets of the Bache fund.

STATED SESSION, APRIL 17-20, 1877.

The treasurer announced the following changes of investment during the year:

During the year the Foran ground rent was sold and the proceeds invested in United States 5 per cent loan, making the amount now invested in United States loan	$42,300
In city of Davenport loan	1,000
Total productive principal	43,300

On motion, it was—

Resolved, That all apparatus procured at the charge of the Bache fund for the use of investigators shall be duly receipted for by those to whom it is loaned, according to forms to be prescribed by the board of direction, and shall be returned to the officer having charge of the property of the academy whenever the investigation for which it was provided is completed, but that it shall at all times be held subject to the disposal of the academy.

STATED SESSION, APRIL 16-19, 1878.

It was reported by the treasurer that by the death of Henry Wood Bache the Bache fund will be increased by the amount of $4,650, according to the terms of the will of Mrs. A. D. Bache.

It was therefore—

Resolved, That Fairman Rogers, treasurer, be authorized to receive from the trustees of Henry Wood Bache all cash and securities payable to the National Academy of Sciences in the settlement of his accounts as trustee, and that he be further authorized to execute all papers required in the transaction.

STATED SESSION, APRIL 18-21, 1882.

The treasurer reported the following changes of investments during the year:

United States loan, 5 per cent (ten-forties), called and redeemed	$2,500
United States loan, 5 per cent (ten-forties), called and redeemed	9,450
	11,950
Purchased United States loan, 3.5 per cent (extended fives)	9,850
Purchased United States loan, 4.5 per cent	2,100
	11,950

Part of lot No. 6, square No. 120, Washington, D. C., has reverted to the legal heirs of A. D. Bache.

Part of lot No. 7, square No. 120, has been sold in accordance with the resolution of the academy, April 19, 1881,[a] and the net proceeds ($790.02) credited to "income of the Bache fund."

STATED SESSION, APRIL 17-20, 1883.

The treasurer presented the following resolution:

Resolved, That the National Academy of Sciences authorize the sale of 160 acres of land, southeast quarter of lot 11, township block 34, range 23, in the State of Missouri, held as part of the estate derived from A. D. Bache, and that the president of the National Academy of Sciences be, and hereby is, authorized and empowered to execute a deed of conveyance to the purchaser, and such other papers as may be required.

The question of the sale of the land mentioned in the resolution was referred to a committee.

STATED SESSION, APRIL 15-18, 1884.

The chairman of the committee on Missouri lands reported that two definite offers had been made for these lands and that the committee recommend that they be not sold.

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[a] *Resolved*, That the rear part of lot 7, in square No. 120, in the city of Washington, in the District of Columbia, as deeded to Joseph Henry, Benjamin Peirce, and James D. Dana, or the survivor or survivors of them, to be held in trust for the benefit of the National Academy of Sciences, by indenture of date the 3d day of March, A. D., 1874, and duly recorded in Liber No. 744, folio 153 et seq., one of the land-record books of the said District of Columbia, be sold unto Seaton Schroeder, of the United States Navy, for the sum of $1,000 cash; and it is further

Resolved, That James D. Dana, surviving trustee named in said indenture of March 3, 1874, be, and he is hereby, authorized and directed to convey the said part of said lot unto the said Seaton Schroeder by a good and sufficient deed in fee simple.

The following resolution was then adopted:

Resolved, That the National Academy of Sciences authorize the sale of 160 acres of land, designated as southeast quarter of lot 11, township block 34, range 23, in the State of Missouri, held as part of the estate derived from A. D. Bache, for a sum not less than $800; and that the president of the National Academy of Sciences be, and is hereby, authorized to execute such deed of conveyance to the purchaser, and such other papers as may be required when he shall regard such sale desirable.

STATED SESSION, APRIL 20–23, 1886.

The academy adopted a recommendation from the council that the gold and other medals presented to the late A. D. Bache, and now in the keeping of the treasurer of the academy, be deposited in the National Museum, subject to the order of the academy.

SPECIAL STATED SESSION, NOVEMBER 9, 1887.

The academy adopted the following resolutions:

Resolved, That Dr. John S. Billings, treasurer of the academy, be, and he is hereby, authorized and empowered to assign any or all District of Columbia 3.65 registered bonds now standing, or which may hereafter stand, in the name of this academy, and to appoint one or more attorneys for that purpose.

Resolved, That Dr. John S. Billings, treasurer of the academy, be, and he is hereby, authorized to collect the interest now due and hereafter to become due on all loans of the city of Philadelphia now standing, or which may hereafter stand, in the name of the Bache fund of the National Academy of Sciences and belonging to this academy.

A motion was adopted requesting the board of direction of the Bache fund to make a detailed report of their expenditures from the beginning to the present time, and to continue it hereafter annually.

STATED SESSION, APRIL 16–19, 1889.

The board of direction of the Bache fund presented the following report:

At the session of the National Academy held at Washington in April, 1888, resolutions were passed calling upon the board of direction of the Bache fund to present a detailed report of their expenditures from the fund up to the present time. A wish was at the same time expressed that references should be given to memoirs and papers containing results obtained through the application of the fund.

The present report is intended to comply as far as possible with the request of the academy. It is drawn, for the greater part at least, from memoranda furnished by Prof. J. H. C. Coffin, from 1881 to 1887 treasurer of the academy.

So far as can now be determined, it has from the beginning been the custom of the board of direction, in case of approval of any application for money from the Bache fund, to indorse their approval upon the application, and then to forward the application to the treasurer for payment.

When the present board came into office, formal rules were adopted requiring the production of proper vouchers for expenditures and also making it necessary that the board of direction should be unanimous. For many years past Prof. J. E. Hilgard, as the only member of the board residing in Washington, has been chairman of the board and has conducted business directly with the treasurer. Applications for money have, it is believed, been most frequently made to him, but sometimes to the other two members of the board. The difficulty in making out an absolutely perfect list of all the appropriations made by the board arises from the fact that the orders prior to April 19, 1884, were stolen from the treasurer's box (together with all other vouchers) in the academy room in the Smithsonian Institution. It is believed, however, that the list herewith furnished up to April, 1888, is nearly, if not quite, complete. (The list which followed is given on pages 39–45.)

SPECIAL STATED SESSION, NOVEMBER 2, 1892.

The following recommendation of the council was approved by the academy:

> That the treasurer be authorized to sell the 4 per cent government bonds belonging to the Bache fund now in the possession of the academy (about $3,800), and to invest the proceeds of such sale under the advice of the investment committee.

STATED SESSION, APRIL 16–18, 1906.

The treasurer reported the following cash addition to the capital of the Bache trust fund during the year:

From sale of Missouri lands This is the net proceeds from the sale of 160 acres of land in Polk County, Mo., belonging to the estate of the late Alexander D. Bache, which was sold, as authorized by the council, at $8.50 per acre.	$1, 288. 20
As thus increased the capital of the fund amounts to	52, 286. 00

ANNUAL MEETING, APRIL 21–23, 1908.

The treasurer made the following statement as to the present condition of the A. D. Bache fund:

Capital account	$52, 286. 00
Invested income	5, 446. 64
Cash on hand	2, 827. 45

APPROPRIATIONS MADE FROM BACHE FUND.[a]

1871.

Sept. 6.	J. E. Hilgard (1) Magnetic survey of the United States.	$500. 00

1872.

Jan. 16.	J. E. Hilgard (2) Magnetic survey of the United States.	500. 00
Jan. 16.	Joseph Winlock (1) Investigation of sun spots.	400. 00

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[a] The list of appropriations to April, 1888, is copied from the report of the board of direction, above mentioned.

Apr. 29.	J. E. Hilgard (3) Magnetic survey of the United States.	$500.00
July 20.	Joseph Winlock (2) Investigations of sun spots.	400.00
Nov. 28.	J. E. Hilgard (4) Magnetic survey of the United States.	1,000.00

1873.

Feb. 17.	Joseph Winlock (3) Investigations in solar physics.	1,200.00
Nov. —.	J. E. Hilgard (5) Magnetic survey of the United States.	1,200.00

1874.

Mar. 16.	Joseph Winlock (4) Investigation of sun spots. The money received by Professor Winlock was employed under his direction in observations of the sun, as described in the preface to Volume VIII of the Annals of the Observations of Harvard University, and the results were published in the second part of the same volume.	500.00
June 15.	J. E. Hilgard (6) Magnetic survey of the United States.	1,200.00

1875.

June 17.	J. E. Hilgard (7) Magnetic survey of the United States.	1,000.00
Oct. 5.	J. E. Hilgard (8) Magnetic survey of the United States.	500.00
Oct. 25.	Charles S. Peirce (1)	400.00
—— —.	——— ——— Study of color.	1,200.00
—— —.	——— ——— Comparison of sensations.	500.00

1876.

Apr. 28.	A. M. Mayer (1) Acoustic researches. Professor Mayer's results are contained in the Memoirs of the National Academy of Sciences, Volume III, part 1, 1884.	250.00
May 24.	J. E. Hilgard (9) Magnetic survey of the United States.	1,000.00
Sept. 18.	Charles S. Peirce (2)	400.00
Nov. 18.	S. P. Langley (1)	500.00
Dec. 12.	Charles S. Peirce (3)	400.00

1877.

May 16.	Wolcott Gibbs (1) Researches on complex inorganic acids.	$100.00
June 13.	A. M. Mayer (2) Researches on nature of the discharge of the inductorium. Memoirs of the National Academy, Volume III, part 1, 1884.	500.00
Oct. 5.	J. E. Hilgard (10) Magnetic survey of the United States, computations of field work from 1871 to 1876. The magnetic survey of the United States was completed in 1876, and the results obtained up to that time were published in detail in the Coast Survey Report for 1882, Appendix 14, 106 pages, 4to.	600.00
Oct. 22.	Wolcott Gibbs (2) Researches on complex inorganic acids.	200.00
Nov. 19.	S. P. Langley (2)	500.00

1878.

Sept. 30.	Charles S. Peirce (4)	500.00
Sept. 30.	C. R. Powalky For a new reduction of La Caill's observations of fundamental stars in the southern heavens in 1749–1757. Published in the Report of the Coast and Geodetic Survey for 1882, Appendix 21, 1879. June 17, to R. M. Willson, treasurer Fort Worth eclipse party, to pay part of the expense of publishing the observations made by the party at Fort Worth in July, 1878. Published: Report of the Observations of the Total Solar Eclipse, July 29, 1878, made at Fort Worth, Tex.	500.00

1879.

Jan. 17.	Leonard Waldo Work on eclipse party. Report published by John Wilson & Son, Cambridge, and distributed to leading observatories and societies.	100.00
May 10.	Samuel Hein	150.00
May 20.	Wolcott Gibbs (3) Researches on complex inorganic acids.	300.00
Aug. 2.	J. C. Watson Computations on the lunar theory.	1,000.00

1880.

Feb. 17.	American Journal of Science Magnetic maps.	60.00
Mar. 13.	C. S. Lyman, for the board of managers of Yale Observatory To aid the thermometric bureau of the university in purchasing standard thermometers and other instruments for its necessary equipment. Reports published: Report of the Board of Managers of the Observatory of Yale University to the President and Fellows, 1880–81 to 1887–88.	500.00

1881.

June 6. S. P. Langley (3) $1,000.00

Observations on physical constitution of the sun.

Dec. 9. Wolcott Gibbs (4) 300.00

Researches on complex inorganic acids.

Doctor Gibbs's work on the complex inorganic acids is not yet completed. Five installments have been published in the Proceedings of the American Academy of Arts and Sciences, Volumes XV, XVI, XVII, XVIII, and XIX.

1882.

July 14. S. Newcomb 1,200.00

Experiments on the velocity of light.

The results of this investigation were published in the astronomical papers of the American Ephemeris, Volume II, parts 3 and 4.

1883.

Apr. 25. Mr. Rockwell (1) 800.00

For the eclipse party.

June 6. Mr. Rockwell (2) 600.00

For the eclipse party.

Results of this expedition were printed in Memoirs of the National Academy of Sciences, Volume II.

Nov. 27. E. S. Holden 300.00

Observations of the aurora borealis and zodiacal light; for the purchase of an aurora spectroscope, $300 (less $20.26 returned), $279.74. This instrument is now at the Lick Observatory, Mount Hamilton, Cal., having been loaned to the observatory by the board of direction of the Bache fund. In consequence of the removal of Professor Holden to California a short time after it was received, no work suitable for publication was done with it.

1884.

Sept. 17. S. P. Langley (4) 1,500.00

Observations on the physical constitution of the sun.

Professor Langley's work has been done partly at the expense of the Bache fund and partly at the expense of other funds, and his results have been published together, so that a precise reference to what has been done with the Bache fund alone is not possible. We may, however, cite the following: American Journal of Science, August, 1887; Memoirs of the National Academy of Sciences for 1883, Volume II; American Journal of Science for March, 1884; the same for January, 1886; the same for August, 1886.

Oct. 22.	Ira Remsen Observations on the influence of magnetism upon chemical action. Two preliminary papers have been published in the American Chemical Journal, Volume VII, page 430. A paper giving the complete results will soon be published in the American Chemical Journal.	$500.00
Nov. 6.	H. B. Hill Study of pyromucic acid. The results of this work have been published in Leibig's Annalen, Volume CCXXXII, page 42; in the Berichte der Deutchen Chem. Gesellschaft, Volume XVIII, page 2095; Volume XX, page 252; Volume XX, page 3359; and in the Proceedings of the American Academy of Arts and Sciences, Volume XXI, page 135; Volume XXII, page 315; Volume XXIII, page 188. Other papers are in press or nearly ready for publication.	200.00
Nov. 20.	E. S. Holden (1) Observations on 303 fundamental stars.	400.00
Dec. 4.	E. H. Hall Investigations in electricity. Results published in the August and October numbers of the American Journal of Science for 1888.	500.00
Dec. 26.	W. M. Davis Observations on the motion of clouds as indicating upper currents. No published report has been made.	50.00

1885.

Mar. 26.	W. M. Davis Observations on thunderstorms.	200.00
Apr. 6.	E. S. Holden (2) Observations on 303 fundamental stars. Professor Holden's work on the observations of fundamental stars appeared in the publications of the Washburn Observatory, Volume IV, 1885.	225.00
May 1.	A. A. Michelson (1) Work on velocity of light.	283.97
June 11.	E. C. Pickering (1) Observations on stellar photography. Professor Pickering's results have been published in the Memoirs of the American Academy of Arts and Sciences, Volume XI, page 179; Volume XVIII, No. 4, of the Annals of Harvard College Observatory; in Volume XVIII, No. 6, of the same; and Volume XVIII, No. 8.	1,000.00
July 2.	J. E. Hilgard (11) Magnetic survey of the United States. (Supplementary work.)	50.00

July 8.	J. E. Hilgard (12) Magnetic survey of the United States. (Supplementary work.)	
July 8.	Yale College Observatory (1) For determination by A. Hall, jr., of the mass of Saturn.	300.00
Nov. 9.	A. G. Webster An investigation of the mechanical equivalent of heat by an electric method. Nothing was accomplished by this work. The apparatus was forwarded to the treasurer at Washington, and $29.11 of the money refunded.	250.00
Dec. 31.	E. C. Pickering (2) Observations on stellar photography.	1,000.00

1886.

Feb. 27.	Yale College Observatory (2) For determination by A. Hall, jr., of the mass of Saturn.	300.00
Mar. 3.	New England Meteorological Society Observations on thunderstorms.	300.00
July 28.	Yale College Observatory (3) For determination by A. Hall, jr., of the mass of Saturn. Mr. Hall, under Doctor Elkin's direction, made observations in 1885–1887, and has since that time been engaged in reducing the same. The details are not yet ready for publication, but the results of his work were communicated to the academy at its meeting in April, 1889.	300.00
Sept. 29.	B. A. Gould (1) Measurements of the Cordova photos.	500.00
Oct. 7.	E. C. Pickering (3) Stellar photography.	1,000.00

1887.

Jan. 30.	B. A. Gould (2) Measurements of the Cordova photos.	500.00
Mar. 22.	A. A. Michelson (2) Researches on light. The results of this work have been published in the American Journal of Science for May, 1886.	500.00
Mar. 24.	H. A. Rowland (1) For work on solar spectrum. Professor Rowland's results have not been published in full. They are partly contained in the American Journal of Science for March, 1887, and are embodied in Professor Rowland's magnificent photographic map of the solar spectrum, second series, 1888. Nine plates, 12 by 36 inches.	1,000.00

June 2.	S. Newcomb Eclipse expedition to Japan. The full report of the expedition, by Prof. D. P. Todd, was presented to the academy April 19, 1889.	$2,000.00
July 26.	A. A. Michelson (3) Researches on light.	500.00
Nov. 15.	Wolcott Gibbs (1) A systematic study of the action of chemical compounds upon the animal system.	1,000.00

1888.

Apr. 25.	T. C. Mendenhall Seismological researches.	100.00
June 10.	E. D. Cope (1) Conducting researches on the extinct vertebrata of North America; for the payment of the salary of one expert preparateur of the fossils in extracting them from the rock, cementing fragments, etc.	600.00
Sept. 15.	E. D. Cope (2) Payment of expenses involved in work on vertebrate paleontology.	600.00
Nov. 2.	D. P. Todd Printing and distributing instructions with reference to observations to be made by volunteers on the total eclipse of January 1, 1889. The results are embodied in part in a paper on composite coronagraphy, read before the academy April 17, 1889.	125.00
Dec. 7.	Wolcott Gibbs (2) A systematic study of the action of chemical compounds upon the animal system.	1,000.00

1890.

Apr. 15.	J. McK. Cattell Investigation of the time taken up by cerebral processes.	600.00
Apr. 15.	J. S. Billings Research on toxalbumins produced by the action of micro-organisms on organic matters, etc.	1,000.00
Apr. 25.	W. K. Brooks Research on Salpa.	500.00
May 16.	S. Newcomb Refraction of light.	150.00
Nov. 19.	D. P. Todd Composite coronagraphy.	50.00
Nov. 26.	Paul S. Yendell Telescopic work, etc.	400.00
Nov. 26.	T. C. Mendenhall Suspected variations in latitude.	1,000.00

1892.

May 16.	Lewis Boss	$1,000.00
June 6.	T. C. Mendenhall Mr. Mendenhall reported that the check for $500 had not been used and the money had been returned.	500.00

1893.

Jan. 23.	W. H. Edwards	500.00
May 1.	S. Weir Mitchell and John S. Billings (1) Effects of light, desiccation, etc., upon vitality and toxic properties of pathogenic bacteria.	1,000.00
June 1.	Lewis Boss (1) Motions of stars and of sun.	1,000.00
Nov. 22.	W. K. Brooks Embryology of Lucifer.	500.00
Dec. 19.	Henry A. Rowland (2) Solar spectrum studies.	1,000.00

1895.

—— —.	J. S. Billings (1) Variability of bacteria.	1,200.00
—— —.	Henry A. Rowland (3) Solar and metallic spectra.	1,000.00

1896.

—— —.	Henry A. Rowland (4) Solar and metallic spectra.	1,000.00
—— —.	Alpheus S. Packard (1) Work on bombycine moths. In continuation of work described in Memoirs of the National Academy of Sciences, Volume VII.	100.00
—— —.	Ira Remsen (1) Atomic weights of zinc and cadmium. (Conducted by H. N. Morse.)	400.00
May —.	J. S. Billings and S. Weir Mitchell (2) Variability of bacteria. This $1,000 was later returned as unexpended.	1,000.00

1897.

Mar. 18.	A. S. Packard (2) Bombycine moths.	100.00
Mar. 29.	R. H. Chittenden Poisonous fungi. An unexpended balance of $465.85 was returned in 1904.	500.00
Apr. 29.	A. A. Michelson Harmonic analyzer and integrator.	400.00

May 1.	John S. Billings (2) Work on colon bacillus.	$500.00
May 5.	A. A. Michelson Work on 2 decimeter standard of length.	(?)
May 17.	Ira Remsen (2) Atomic weight of cadmium. (Conducted by H. N. Morse.)	400.00
May 22.	Alexander Agassiz Borings in Fiji Island coral reefs.	1,200.00
Dec. 7.	A. S. Packard (3) Bombycine moths.	100.00

1898.

May 17.	H. A. Rowland (5) Solar and metallic spectra.	1,000.00
May 25.	Lewis Boss (2) Motions of stars.	1,000.00
May 25.	T. C. Mendenhall Absolute gravity.	500.00

1899.

Mar. 7.	John S. Billings Effects of alcohol on metabolism in the human body. On April 8 $46.97 was returned as unexpended.	250.00
Nov. 8.	H. A. Rowland (6) Solar spectrum, wave lengths, etc. An unexpended balance of $206.58 was later returned from the executor of Professor Rowland's estate.	700.00
Nov. 9.	A. S. Packard (4) Bombycine moths.	100.00

1900.

Apr. 5.	H. C. Wood Pulmonic and systemic circulation.	300.00
Apr. 10.	Lewis Boss (1) Standard stars.	1,000.00
Apr. 11.	Asaph Hall, jr. Constant of aberration and the variation of latitude.	250.00
Apr. 28.	A. S. Packard (5) Bombycine moths.	300.00
Oct. 15.	E. C. Franklin Solutions in substituted ammonias.	150.00

1901.

Jan. 8.	S. Weir Mitchell and Simon Flexner (1) Snake venom.	600.00
Mar. 5.	Lewis Boss (2) Standard stars.	1,000.00

Mar. 26.	Alpheus Hyatt Measurement of the Achatinellidæ of the Hawaiian Islands. On Professor Hyatt's death, arrangements were made with Mr. Alfred G. Mayer for the completion of the work.	$600.00
Mar. 28.	A. S. Packard (6) Bombycine moths (drawings).	300.00
May 11.	Charles L. Doolittle Constant of aberration.	500.00
Sept. 10.	Ira Remsen Solar spectrum work of Rowland to be continued by L. E. Jewell.	1,000.00
Oct. 12.	Edward S. Morse Living brachiopods for illustration.	500.00
Nov. 1.	Charles Baskerville Thorium.	300.00
Jan. 21.	S. Weir Mitchell and Simon Flexner (2) Snake venom.	800.00
Dec. 9.	Lewis Boss (3) Standard stars.	300.00

1903.

Mar. 2.	S. Newcomb Cause of sex, etc.	50.00
Apr. 2.	R. H. Chittenden Minimum proteid requirement.	1,000.00
May 11.	Charles L. Doolittle (1) Variations of latitude, etc.	1,000.00
May 18.	H. C. Wood Physiological effects of *Apocynum cannabinum*.	250.00
May 20.	Harry W. Morse Luminescence of crystals.	200.00
June 8.	W. K. Brooks Salpa and other Pelagic tunicates.	500.00
June 30.	Theodore Lyman Wave lengths in ultra violet.	200.00

1904.

Jan. 21.	A. S. Packard (7) Bombycine moths (drawings).	200.00
Feb. 28.	Wallace C. Sabine Luminescence in electric spark.	250.00
Mar. 14.	Theodore Lyman (1) Schumann short wave lengths.	150.00

Mar. 17.	W. T. Porter Stimulation of muscle. This $300 was later returned as unexpended.	$300.00
May 5.	H. C. Wood Action of alcohol upon circulation.	300.00

1905.

Mar. 27.	C. L. Doolittle (2) Variations of latitude, etc.	500.00
Sept. 18.	H. C. Wood Vaso-motor system of the lungs.	300.00
Oct. 7.	Theodore Lyman (2) Spectra of gases, etc., in Schumann's short wave lengths.	300.00
Nov. 27.	American table in laboratory at the Col d' Olen on Monte Rosa	500.00
Dec. 5.	Duncan S. Johnson Piperacea, etc., of Jamaica.	400.00

1906.

Sept. 30.	Joseph S. Ames (1) Revision of Rowland's standards.	300.00

1908.

Apr. —.	Joseph S. Ames (2) Revision of Rowland's standards.	1,000.00
Apr. —.	Gilbert N. Lewis To determine the free energy of formation of the important compounds of the alkali metals.	300.00

BOARDS OF DIRECTION OF THE BACHE FUND.

Under the terms of Professor Bache's will, dated March 18, 1862, Messrs. Joseph Henry, Louis Agassiz, and Benjamin Peirce were constituted a board of direction, which was given power to continue its existence. There is no further record of the membership of the board of direction of the Bache fund prior to 1883.

1883–1890.

J. D. Dana.	J. E. Hilgard.	W. Gibbs.

1891 and 1892.

W. Gibbs.	J. D. Dana.	B. A. Gould.

1893–1895.

W. Gibbs.	B. A. Gould.	G. L. Goodale.

	1896.	
W. Gibbs.	S. C. Chandler.	G. L. Goodale.
	1897–1902.	
W. Gibbs.	S. C. Chandler.	S. H. Scudder.
	1903–1907.	
S. C. Chandler.	H. P. Bowditch.	Ira Remsen.
	1908.	
S. C. Chandler.	Charles S. Minot.	Ira Remsen.

THE JOSEPH HENRY FUND.

STATED SESSION, APRIL 16–19, 1878.

The "Joseph Henry fund" of $40,000 was contributed by "Fairman Rogers, Joseph Patterson, George W. Childs, A. J. Drexel, F. A. Drexel, Charles H. Rogers, J. G. Fell, Isaac Lea, Asa Packer, John Welsh, William Blanchard, James Lenox, The Executors of the Estate of John C. Green, Mrs. John C. Green, Robert L. Stuart, Miss C. L. Wolfe, William Libbey, E. N. Dickerson, Cyrus W. Field, Thomas A. Scott, Wm. W. Corcoran, George P. Wetmore, Thomas H. Powers, J. S. Morgan, J. Pierrepont Morgan, I. V. Williamson, John W. Garrett, Charles S. Coxe, Cyrus H. McCormick, J. E. Caldwell, Wm. Weightman, Alexr. Brown, Henry C. Gibson, J. Donald Cameron, Samuel M. Felton, Henry H. Houston, Nathaniel Thayer, John L. Cadwalader, and J. F. Navarro"—

as an expression of the donor's respect and esteem for Prof. Joseph Henry's personal virtues, their sense of his life's great devotion to science with its results of important discoveries, and of his constant labors to increase and diffuse knowledge and promote the welfare of mankind.

This sum of $40.000 the contributors caused to be invested in certain securities, and to be deposited with and held by the Pennsylvania Company for Insurance of Lives and Granting Annuities in Trust, which company was required to collect the income thereon from time to time, and to pay over the same to Prof. Joseph Henry during his natural life, and after his death, to his wife and daughters, and after the death of the last survivor "to deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust by the National Academy of Sciences under the name and title of 'the Joseph Henry fund,' the principal to be forever held intact and the income to be from time to time applied by the said National Academy of Sciences in its sole discretion to assist meritorious investigators especially in the direction of original research."

Resolutions were adopted thanking the donors, accepting the said trust, and directing, authorizing, and empowering Fairman Rogers, treasurer of the academy, in its name and upon its behalf, to affix its corporate seal to and to execute all such deeds, writings, and assurances in law as might be necessary to carry the said trust into effect.

TRUSTEE OF TYNDALL FUND.

SCIENTIFIC SESSION, OCTOBER 28–30, 1879.

The president of the academy stated that the death of Prof. Joseph Henry had created a vacancy in the board of trustees of "the Tyndall fund for American scientific students," and the terms of Professor Tyndall's deed of trust made it the duty of the president of the National Academy to fill such vacancies whenever they occurred. He had accordingly appointed President F. A. P. Barnard, of Columbia College, to fill the vacancy.

SCIENTIFIC SESSION, NOVEMBER 16–19, 1880.

The president stated that he had appointed (May, 1880) Prof. Joseph Lovering, of Cambridge, to fill a vacancy in the board of trustees of the Tyndall fund caused by the death of Gen. Hector Tyndall, of Philadelphia.

THE J. C. WATSON FUND.

The will of Mr. James C. Watson, dated July 11, 1874, contains the following provisions:

> Fifth. I give and devise subject to conditions and legacies hereinbefore and hereafter mentioned all the rest, residue and remainder of my real and personal estate to the National Academy of Sciences of the United States of America, of which I am a member, which said Academy was incorporated by Act of Congress, approved March third, A. D., 1863, to be aggregated, kept and invested as a perpetual fund the income from which shall be expended by said Academy for the promotion of Astronomical Science. * * * * I direct that all other [other than those specifically bequeathed otherwise] stocks bonds and securities owned by me be converted into money on the most advantageous terms possible and as soon as it may be advantageous to do so and paid over to the Treasurer of said National Academy of Sciences. I direct that any other personal property belonging to me, as well as any real estate of which I may die possessed, except my books and scientific papers, be sold and disposed of as soon as may possibly be done advantageously to the interests of my estate and that the proceeds thereof be paid over to the Treasurer of said National Academy of Sciences.
>
> I direct that my books and scientific papers be transferred to said National Academy of Sciences, to become a part of the library of said Academy.
>
> In order to carry out the wish hereinbefore expressed as to the disposal of the income from the fund resulting from my estate hereby devised to said National Academy of Sciences, I do hereby direct that the designation of the

particular objects and works which may be aided by this fund shall be determined, subject to approval by a vote of the Academy, by a Board of Trustees, three in number, who shall be members of the Academy and elected, after the first herein named, by said Academy whenever a vacancy may occur by death or otherwise. The trustees so appointed shall hold said office, unless voluntarily relinquished by them, during the period of their membership in the said National Academy of Sciences, and I do hereby appoint and constitute Julius E. Hilgard of the United States Coast Survey and Simon Newcomb and J. H. C. Coffin, Professors of Mathematics U. S. Navy, all of Washington in the District of Columbia, to be the first Board of Trustees for the purposes herein named.

It is my wish that the Academy may if it shall seem proper provide for a gold medal of the value of one hundred dollars to be awarded with a further gratuity of one hundred dollars, from time to time to the person in any country who shall make any astronomical discovery or produce any astronomical work worthy of special reward as contributing to our science. It is my further wish that provision be made for preparing and publishing tables of the motion of all the planets which have been discovered by me, as soon as it may be practicable to do so and I desire that in all cases the trustees and the Academy shall act in harmony to obtain results of the greatest possible aid to our Science from the income fund resulting from my estate. I desire that results so obtained shall be published as speedily as possible in such manner as may be provided by the Academy.

I direct that the said National Academy of Sciences take all necessary and proper measures to invest the funds resulting from the property hereby devised where they may be safe and yield the largest income possible consistent with safety.

STATED SESSION, APRIL 19, 1881.

Mr. Simon Newcomb made the following statement:

It is known to members of the academy that our late lamented colleague, Prof. James C. Watson, has bequeathed all his estate, after satisfying certain claims and paying certain annuities to relatives, to the National Academy of Sciences, in trust, for the promotion of astronomical researches. Having been named one of the executors, I took occasion, during a journey to Madison last January, to inform myself as to the condition of the estate and the probable benefits to be derived from it. I find that, although almost the entire property was in the State of Michigan, yet, as he was a resident of Wisconsin at the time of his death, and as his estate was entirely personal, the courts of the latter had exclusive jurisdiction of the bequest.

As none of the executors named in the will are residents in Wisconsin, and as they are widely scattered, it will be difficult for more than one to act, and the administration will have to be conducted under the direction of the probate court at Madison.

It is difficult to see what amount, if any, the academy will ultimately receive for the purposes desired by the testator, owing to two causes—the unsettled condition of several business enterprises in which our colleague had invested much of his means, and the indefinite character of his business arrangements with the University of Wisconsin. The only item of the estate to which even an approximate cash value can be assigned consists of stock and policy in the Mutual Life Insurance Company of Michigan, the total value of which probably amounts to about $30,000.

The next item in importance is the Printing and Publishing Company of Ann Arbor, of which the deceased owned 499 shares out of the total of 500. The actual cost of this stock was about $26,000, but the property at present owned by the company is of so miscellaneous a character and it is so complicated by litigation as to make it hardly possible even to guess at the value of its assets.

I judge, however, from a general examination of its property, that should the company go into liquidation it might realize anywhere from $5,000 to $15,000, but a debt of $5,000 is due from it, so that the net amount may range from zero to $10,000, the lower ultimate being more probable than the upper one.

The next item in importance is the Chase Publishing Company, of Toledo, which is said to be profitable; but to it no definite value can be assigned.

On the other hand, our colleague at Madison expended considerable sums on improvements of the observatory and its grounds without any distinct understanding with the board of regents as to who should ultimately bear the expense. These improvements include the Watson solar observatory, the students' observatory, the fitting up of the director's house, the purchase of the transit instrument, and several other items. An amount of between $5,000 and $10,000 is, I believe, due on these various improvements, so that if the estate is to pay for them all, it will be materially diminished.

I may also add that under the laws of Wisconsin Mrs. Watson is entitled, in lieu of the provison made for her in the will, to accept one-third of the net proceeds of the estate. It has been suggested that in the event of the estate not realizing the amount expected an arrangement should be made with Mrs. Watson to allow her the entire income from it during her life on condition of the entire amount reverting to the academy on her death. This arrangement will probably commend itself if the amount shall be found insufficient to carry out the objects which our lamented colleague had at heart in making the bequest.

The matter of the action of the academy on the Watson bequest was referred to the council.

STATED SESSION, APRIL 17–20, 1883.

The treasurer made the following report:

Receipts:		
Cash from L. Gruner, executor estate J. C. Watson		$7,050.25
Dividends on stock of Michigan Mutual Life Insurance Company	$768.75	
Interest on $6,200 United States loan, 4.5 per cent	139.50	
		908.25
		7,958.50
Expenditures:		
Appropriation by board of trustees for search for intra-mercurial planet	300.00	
Cost of $6,200 United States loan, 4.5 per cent, of which $23.25 is accrued interest	7,013.75	
		7,313.75
Balance, cash, of which $36.50 is uninvested capital		644.75
Investments:		
United States loan, 4.5 per cent	6,200.00	
134 shares capital stock Michigan Mutual Life Insurance Company received from L. Gruner, executor, par value	6,700.00	
		12,900.00

The treasurer made the following statement:

The final account of Leopold Gruner, the only executor named in the will of Mr. Watson, was rendered to the county court of ———— county, in the State of Wisconsin, May 31, 1882.

Mrs. Annette H. Watson claimed, and was allowed under the laws of Wisconsin, one-third of the estate of her late husband in lieu of the bequests made to her.

The decree of the court made July 5, 1882, adjudges that the said executor retain in his hands the sum of $3,000 for the purpose of paying the annuity bequeathed by the said James C. Watson, deceased, to his mother, Rebecca E. Watson.

"That all the rest, residue, and remainder of said personal estate, consisting of the sum of five thousand and fifty-seven dollars and twenty-five cents in cash, one hundred and seventy-four shares of said stock of the Michigan Mutual Life Insurance Company, and the undivided two-thirds of said miscellaneous books, and all and singular the said books and scientific papers as delivered by said executor to it, be, and the same are hereby, assigned and set over to the said National Academy of Sciences, its successors and assignees."

Under this decree I have received from the executors $7,057.25 in cash and 134 shares of stock of the Michigan Mutual Life Insurance Company, the reduction of 40 shares of the Michigan Mutual Life Insurance Company, and the increase of $2,000 having been made at the request of Mrs. Watson.

STATED SESSION, APRIL 15–18, 1884.

The following recommendations of the trustees of the Watson fund (based on a cash balance of $1,292.75 and an annual income of $748 from present investments) were adopted:

(1) That the invested fund be increased by the addition of $850.25, so that its par value may equal as near as may be $13,750.25, the sum received from Professor Watson's estate.

(2) That dies with suitable designs be prepared for a medal to be awarded from time to time to the person in any country who shall make any astronomical discovery or produce any astronomical work worthy of special reward and contributing to the progress of astronomy, in compliance with the expressed wishes of Professor Watson.

(3) That there be set aside annually the sum of $500, or as much thereof as may be necessary and available, to commence work on tables of the small planets discovered by Professor Watson, as also expressly desired by him in his bequest to the academy, such work to be under the direction of Mr. Newcomb.

STATED SESSION, APRIL 21–24, 1885.

The treasurer reported that since the session of April, 1884, in accordance with resolutions then passed, the invested fund had been increased to $13,750; the sum received from the bequest of Professor Watson; progress had been made in procuring a model of the proposed Watson medal; and the work on the small planets under the direction of Mr. Newcomb had been commenced, but no money had yet been drawn from the treasury for that purpose.

SPECIAL STATED SESSION, NOVEMBER 14, 1888.

The academy approved the action of the trustees in voting to expend a sum not exceeding $800 to enable Prof. G. C. Comstock to make a determination of the constant of aberration at the Madison Observatory.

SPECIAL STATED SESSION, NOVEMBER 11, 1891.

The following resolution was adopted:

Resolved, That the treasurer, Dr. John S. Billings, is authorized to sell the 134 shares (par $50) of stock of the Michigan Mutual Life Insurance Company now held in the name of the academy for the price named in the offer of Mr. Dusenberry in his letter of the 9th instant, viz, $160 and accrued interest to date, and to invest the proceeds of this sale as proposed by the treasurer in his letter of the 9th instant.

STATED SESSION, APRIL 19–22, 1892.

The treasurer reported that the capital fund investments amounted to $18,666.88.

SPECIAL SESSION, NOVEMBER 8, 1893.

The following resolution was adopted:

Resolved, That the trustees of the Watson fund be authorized by the academy to transfer such papers of the late Prof. James C. Watson as they think proper, from the Washburn Observatory at Madison, Wis., to the observatory at Ann Arbor, Mich.

ANNUAL MEETING, APRIL 15–17, 1902.

The chairman of the Watson trustees reported that since the last annual meeting an arrangement had been made with Prof. A. O. Leuschner, of the University of California, for his superintendence of the computing of the perturbations of the Watson asteroids by two of his assistants.

ANNUAL MEETING, APRIL 16–18, 1906.

The treasurer reported that $3,000 had been added to the capital of the Watson trust fund during the year from the estate of L. Gruner.

This was a residual portion of the Watson estate that had been held in trust to secure the payment of annuities to the parents of Professor Watson. Both parents having died, this amount has been paid over to the National Academy of Sciences by the executor of the estate of L. Gruner, who was himself executor of the estate of Professor Watson. With this increase and previous additions from accumulated income, the capital of the fund now amounts to $25,000.

ANNUAL MEETING, APRIL 16–18, 1907.

The chairman of the board of trustees of the Watson fund reported a delay in the completion of the first 12 tables of the Watson asteroids.

The academy approved a recommendation of the trustees that the entire work be published as two volumes or parts of the memoirs of the academy, one containing the tables, the other the researches on which they are founded.

ANNUAL MEETING, APRIL 21–23, 1908.

The board of directors reported that the tables for 12 out of the 22 small planets discovered by Professor Watson have been submitted to the academy for printing.

The following resolution was adopted:

Whereas the work on the computations of the Watson asteroids having involved unexpected expense so as to temporarily exceed the actual income, although the income is sufficient to finally meet this expense: It is hereby

Resolved, That the trustees of the Watson fund are hereby authorized to advance out of the general fund up to $1,000 when found necessary to continue the computations of the Watson asteroids, it being understood that the money thus used is to be returned later, and that the computations shall be completed not later than 1910.

RECIPIENTS OF THE WATSON MEDAL AND ONE HUNDRED DOLLARS IN GOLD.

1. 1887. Benjamin Apthorp Gould.
   For valuable labors in promoting the progress in astronomical science, and especially for his establishment of the National Observatory of the Argentine Republic.
2. 1889. Ed. Schönfeld.
   For services in cataloguing and mapping the stars visible in our latitudes, and especially for his [then] recently published southern "Durchmusterung." (The medal and gold were forwarded through the German embassy at Washington.)
3. 1891. Arthur Auwers.
   For his contributions to stellar astronomy. (The medal and gold were forwarded through the German embassy at Washington.)
4. 1894. Seth Carlo Chandler.
   For researches on the variation of latitude.
5. 1899. Sir David Gill.
   For work in perfecting the application of the heliometer to astronomical measurements.

GRANTS FROM THE WATSON FUND.

April 17, 1883	$300.00
For search for intramercurial planet.	
April 15, 1884	100.00
Solar eclipse of 1883.	
April 21, 1885	100.00
Drawings for solar eclipse report.	

April 20, 1886 Work on asteroids.	$202.50
April 19, 1887. Simon Newcomb Reduction of asteroids.	292.00
October 19, 1888. G. C. Comstock Determination of the constant of aberration for the observatory at Madison, Wis.	800.00
April 19, 1892. S. C. Chandler (1) Investigations regarding the variation of latitude.	500.00
April 18, 1893. S. C. Chandler (2) Services of a computer to assist in investigating the variation of latitude and the constant of aberration.	500.00

Since April 16, 1901:

The income from the Watson fund since April 16, 1901, has been used in the computing of the perturbations of the Watson asteroids under the superintendence of Prof. A. O. Leuschner, of the University of California.

TRUSTEES OF THE WATSON FUND.

1883–1886.

J. E. Hilgard. S. Newcomb. J. H. C. Coffin.

1887–1889.

S. Newcomb. J. H. C. Coffin. B. A. Gould.

1890–1895.

S. Newcomb. B. A. Gould. A. Hall.

1896–1898.

S. Newcomb. A. Hall.

1899–1902.

S. Newcomb. A. Hall. Lewis Boss.

1903–1908.

S. Newcomb. W. L. Elkin. Lewis Boss.

THE HENRY DRAPER FUND.

STATED SESSION, APRIL 17–20, 1883.

The president announced that Mrs. Henry Draper, widow of Henry Draper, late an honored member, had presented to the National Academy of Sciences a fund of $6,000 for the establishment of a gold medal to be awarded by the academy every two years to the individual in this or any country who makes the most important discovery in astronomical physics, the value of said medal to be

$200; and the fund, in case the medal should not be awarded, to be applied by the academy to investigations in the same department of science.

The text of the deed of gift is as follows:

Know all men by these presents that I, Mary Anna Palmer Draper of the City, County and State of New York, in consideration of the premises, and of the acceptance of the within trust by the National Academy of Sciences and also in consideration of divers other good and valuable considerations, we, the said Mary Anna Palmer Draper hereto moving, have given, granted, assigned, transferred and set over and by these presents do give, grant, assign, transfer and set over unto the said National Academy of Sciences and to their successors forever, a certain fund or sum of Six thousand dollars with the interest and income thereof To have and to hold the same in trust nevertheless upon the special trusts and for the uses and purposes following, to wit:

First. In trust to invest and to reinvest the said sum of Six thousand dollars and to keep the same invested in good and safe securities, or in such other manner as shall be, in their opinion, best for the preservation and maintenance of said fund.

Second. In trust to use the interest and income thereof for the purpose of striking a gold medal which shall be called the "Henry Draper Medal," shall be of the value of Two hundred dollars, and shall be struck in a die to be selected and presented to said National Academy of Sciences by me, the said Many Anna Palmer Draper. And the said medal shall be awarded and presented, from time to time, by the said National Academy of Sciences, to any person in the United States of America or elsewhere who shall make an original investigation in astronomical physics the results of which shall be made known to the public, such results being in the opinion of the said National Academy of Sciences of sufficient importance and benefit to science to merit such recognition, provided however that said medal shall not be presented or awarded more frequently than once in two years, and provided also that the investigation for which it is awarded or the completed publication thereof shall have been made since the time of the last preceding award and presentation of said medal.

Third. In trust that if discoveries of equal importance shall be made in astronomical physics at or about the same time in the United States of America and also in some other part of the world, each of which discoveries might in the opinion of said Academy entitle the discoverer to be considered as a competitor for said medal, preference shall be given in the awarding thereof to discoveries made by a citizen of the said United States of America.

Fourth. In trust that if the said die shall at any time be lost, destroyed, broken, or in any manner rendered unfit for the purpose of striking the said medal, a new die shall be procured exactly similar to the one so selected and presented as aforesaid, and shall be paid for out of the interest and income of said fund; and such sum or sums of money as shall at any time or times be necessary for the proper care, custody and protection of the said die or of the said fund hereby given, shall also be taken from and out of the interest and income of the said fund whenever the same shall be deemed necessary by the said National Academy of Sciences.

Fifth. In trust that, if at any time or times the interest or income of the said trust fund of Six thousand dollars shall exceed the amount necessary for the striking of said medal, and the care of the said die and of the fund, such surplus over or above the sum or sums so required for the purposes of the trust as hereinbefore recited and set forth shall be used in such manner as shall be selected by said National Academy of Sciences in aid of investigations and work in astronomical physics to be made and carried on by a citizen or citizens of the United States of America.

And the said National Academy of Sciences doth signify its acceptance of the said fund of Six thousand dollars, and doth engage to hold and manage the same upon the trusts and for the uses and purposes herein mentioned and set forth.

In Witness whereof, I, the said Mary Anna Palmer Draper have hereunto set my hand and seal, and the said National Academy of Sciences hath hereunto caused its corporate seal to be affixed and these presents to be subscribed by its President, this thirteenth day of April, in the year eighteen hundred and eighty-three.

Mary Anna Palmer Draper, [seal.]
O. C. Marsh, [seal N. A. S.]
President of National Academy of Sciences.

Sealed and delivered in presence of Edward H. Dixon, Mornay Williams, as to Mary Anna Palmer Draper.

Witnesses to signature of President Marsh: J. H. C. Coffin, Asaph Hall, Saml. H. Walker.

Executed and acknowledged before Mornay Williams, Notary Public, New York Co.

Acknowledgment of officer of the Academy before Saml. H. Walker, Notary Public, Dist. of Columbia.

The following resolution was adopted:

Resolved, That the National Academy of Sciences accepts the fund of six thousand dollars presented to it by Mrs. Mary Anna Palmer Draper, and engages to maintain the same upon the trusts for the uses and purposes mentioned and set forth in a certain deed executed by her on the thirteenth of April, in the year of our Lord one thousand eight hundred and eighty-three, and signifies such acceptance by causing the corporate seal of the academy to be affixed, and the said deed to be signed by its president.

The following resolution was adopted:

Resolved, That a permanent committee of five be appointed to consider the subject of the bestowal of the Henry Draper medal, and to recommend to the academy, from time to time, such persons as they may consider deserving of the medal, with the grounds of their recommendations.

STATED SESSION, APRIL 15–18, 1884.

The treasurer reported that the $6,000 received from Mrs. Draper April 20, 1883, had been expended in the purchase of $5,000 United States 4 per cent bonds.

The following resolution, drawn up by a committee appointed at the last stated session, was adopted:

Resolved, That the grateful acknowledgments of the National Academy of Sciences are due to Mrs. Henry Draper for the confidence which she has shown in selecting the academy as the trustee of a fund designed to reward scientific labor, and by so doing to commemorate the services of one who was loved for his virtues and honored for his eminent success in the branch of science to which he devoted his noble and useful life.

STATED SESSION, APRIL 21–24, 1885.

The following resolution was adopted:

Resolved, That the treasurer be authorized to reserve from the income of the Draper fund sixty-five dollars each year, and such further sum as the committee on that fund may authorize, to be invested from time to time until the invested fund is increased to six thousand dollars, the sum intrusted to the academy by Mrs. Draper.

STATED SESSION, APRIL 20–23, 1886.

The committee on the Henry Draper medal submitted the following statement and recommendations:[a]

The deed of gift of the fund for this medal contains a provision "that the investigation for which it is awarded or the completed publication thereof shall have been made since the time of the last preceding award and presentation of the said medal."

We find that this provision restricts the consideration of works for which the medal may be awarded in a way and degree which we believe that the generous donor did not intend. Most great works of the present time have no definite time of ending, being continued from year to year, and seeing the light only in a series of publications, no one of which can be regarded as fully completing the work. In other cases the value of an epoch-making work may not be fully recognized at the time of making an award to some other work. In the first case, an award would, as the provision now stands, be of questionable legality; in the second, entirely illegal.

Believing that this restriction upon the award will be recognized by the academy and by the donor as inexpedient, we recommend that the academy submit a statement of the case to Mrs. Draper with the respectful request that she consider the expediency of modifying her deed of gift by annulling the provision above quoted.

The academy adopted a motion recommending that the donor of the fund be requested to cancel the following clause contained in the deed of gift:

That the investigation for which it is awarded, or the completed publication thereof, shall have been made since the time of the last preceding award and presentation of the said medal.

STATED SESSION, APRIL 21–24, 1891.

The following resolution was adopted:[b]

Resolved, That it is the opinion of the academy that the power to decide as to what investigations shall be made at the expense of the income of the Draper fund can not be delegated by the academy, and that applications for aid from this fund should be forwarded to the academy by the standing committee on this fund, with its recommendation in each case.

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[a] Similar recommendations were made by the committee on the J. Lawrence Smith fund. (See p. 65.)

[b] A similar resolution was adopted concerning the J. Lawrence Smith fund. (See p. 65.)

ANNUAL MEETING, APRIL 21–24, 1896.

The treasurer reported that the Draper fund had been increased to $7,903.75 by the transfer of invested income.

ANNUAL MEETING, APRIL 19–21, 1904.

The fifth clause of the deed of gift by Mrs. Henry Draper, establishing the Henry Draper fund, is as follows:

> Fifth. In trust, that if at any time or times the interest and income of the said fund of $6,000 shall exceed the amount necessary for the striking of said medal and the care of the said die and of the fund, such surplus over and above the sum or sums so required for the purposes of the trust as hereinbefore recited and set forth shall be used in such manner as shall be selected by said National Academy of Sciences, in aid of investigation and work in astronomical physics to be made and carried on by a citizen or citizens of the United States of America.

In a letter dated June 22, 1903, Mrs. Draper writes:

> With reference to the Henry Draper medal fund of the National Academy of Sciences, my desire is that the income thereof, above what is required to provide the Draper medals, should be allowed to accumulate and should be added to the principal until the latter amounts to $10,000. Thereafter any excess of income of this fund over and above that needed for the purchase of medals I should be willing to have used, under the direction of the academy, for purposes of research in the line for which the fund was originally given.

The academy therefore adopted the following resolution:

> *Resolved*, That the treasurer be instructed to reserve the income of the Draper fund not required for the giving of the Draper medal and to invest it until the original fund amounts to $10,000: *Provided*, That in a case of exceptional importance the trustees of the Draper fund be instructed to bring the application for a grant before the academy.

ANNUAL MEETING, APRIL 21–23, 1908.

The treasurer reported that the capital of the Draper fund had reached the amount of $10,000, as requested by Mrs. Draper.

RECIPIENTS OF DRAPER GOLD MEDAL.

1. 1886. Samuel Pierpont Langley.
   For researches and discoveries in relation to solar radiation.
2. 1888. Edward Charles Pickering.
   For recent work in astronomical photometry and photography.
3. 1890. Henry Augustus Rowland.
   For researches on the solar spectrum.
4. 1893. Hermann Karl Vogel.
   For spectroscopic observations upon the motion of stars in the line of sight.
5. 1899. James Edward Keeler.
   For researches in spectroscopic astronomy.
6. 1901. Sir William Huggins.
   For investigations in astronomical physics.
7. 1904. George Ellery Hale.
   For investigations in astronomical physics.

GRANTS FROM THE DRAPER FUND.

April 18, 1893. Henry Augustus Rowland Researches upon the solar spectrum.	$500.00
April 3, 1901. William Wallace Campbell For construction of 1-prism spectograph for 36-inch telescope at the Lick Observatory.	500.00
April 3, 1901. George Ellery Hale Construction of horizontal cœlostat reflecting telescope of 24-inch aperture for Yerkes Observatory.	500.00
April 21, 1903. William Wallace Campbell Micrometer microscope.	351.00

COMMITTEES ON THE HENRY DRAPER FUND.

1883–1894.

G. F. Barker. Wolcott Gibbs. S. Newcomb.
A. W. Wright. C. A. Young.

1895–1899.

G. F. Barker. S. Newcomb. J. Trowbridge.
A. W. Wright. C. A. Young.

1900–1904.

E. C. Pickering. S. Newcomb. J. Trowbridge.
A. W. Wright. A. A. Michelson.

1905–1908.

S. Newcomb. G. E. Hale. J. Trowbridge.
A. W. Wright. A. A. Michelson.

THE J. LAWRENCE SMITH FUND.

STATED SESSION, APRIL 21–24, 1885.

The president made the following statement:

At the last annual meeting the academy received a letter, dated April 3, 1884, from Mrs. J. Lawrence Smith in which she expressed her intention of presenting to the academy a trust fund in memory of her late husband.

Soon after the adjournment of that session this proposed gift was made, the sum of $8,000 was placed in the hands of the treasurer, and the accompanying deed of gift was duly executed by Mrs. Smith as donor and by the president on the part of the academy. The object of this memorial gift is to promote the study of meteoric bodies, a branch of science which Doctor Smith had pursued with eminent success; and, in accordance with the wishes of the donor, it was decided that a gold medal, to be given as a reward for original investigations, would be most appropriate. Mrs. Smith has most generously offered to defray the expense of having the die for the medal prepared, and has selected as artist Chaplain, of Paris.

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The secretary then read the following deed of gift from Mrs. Smith to the National Academy of Sciences:

Know all men by these presents, that I, Sarah Julia Smith, of the City of Louisville, and County of Jefferson, State of Kentucky, in consideration of the premises and of the acceptance of the within trust by the National Academy of Sciences, and, also, in consideration of divers other good and valuable considerations, I, the said Sarah Julia Smith, hereto moving, have given, granted, assigned, transferred, and set over, and by these presents do give, grant, assign, transfer, and set over unto the said National Academy of Sciences and to their successors forever, a certain fund or sum of Eight thousand dollars with the interest and income thereof, to have and to hold the same in trust nevertheless—upon the special trusts and for the uses and purposes following, to wit:

First. In trust to invest and to reinvest the said sum of Eight thousand dollars, and to keep the same invested in good and safe securities, or in such other manner as shall be in their opinion best for the preservation and maintenance of such fund.

Second. In trust to use the interest and income thereof for the purpose of striking a gold medal which shall be called the "Lawrence Smith Medal," shall be of the value of Two hundred dollars in gold, and shall be struck in a die to be selected and presented to the said National Academy of Sciences, by me, the said Sarah Julia Smith. And the said medal shall be awarded and presented from time to time, by the said National Academy of Sciences, to any person in the United States of America or elsewhere who shall make an original investigation of meteoric bodies the results of which shall be made known to the public, such results being in the opinion of the said National Academy of Sciences of sufficient importance and benefit to science to merit such recognition, provided, however, that said medal shall not be presented or awarded more frequently than once in two years, and provided, also, that the investigation for which it is awarded or the completed publication thereof shall have been made since the time of the last preceding award and presentation of said medal.

Third. In trust that if investigations of equal importance shall be made in regard to meteoric bodies at or about the same time in the United States of America and, also, in some other part of the world, each of which investigations might in the opinion of said Academy entitle the investigator to be considered as a competitor for said medal, preference shall be given in the awarding thereof to investigations made by a citizen of the said United States of America.

Fourth. In trust, that if the said die shall at any time by lost, destroyed, broken, or in any manner rendered unfit for the purpose of striking the said medal, a new die shall be procured exactly similar to the one so selected and presented as aforesaid, and shall be paid for out of the interest and income of the said fund; and such sum or sums of money as shall at any time or times be necessary for the care, custody and protection of the said die or of the said fund hereby given, shall also be taken from and out of the interest and income of the said fund whenever the same shall be deemed necessary by the said National Academy of Sciences.

Fifth. In trust that, if at any time or times the interest and income of said trust fund of Eight thousand dollars shall exceed the amount necessary for the striking of said medal and the care of the said die and of the fund, such surplus over and above the sum or sums so required for the purposes of the trust as hereinbefore recited and set forth shall be used in such manner as shall be selected by the National Academy of Sciences in aid of investigations of meteoric bodies to be made and carried on by a citizen or citizens of the United States of America.

And the said National Academy of Sciences doth signify its acceptance of the said fund of Eight thousand dollars and doth engage to hold and manage the same upon the trusts and for the uses and purposes herein mentioned and set forth.

In witness whereof, I, the said Sarah Julia Smith, have hereunto set my hand and seal, and the said National Academy of Sciences hath hereunto caused its corporate seal to be affixed and these presents to be subscribed by its President, this sixth day of May, in the year one thousand eight hundred and eighty-four.

Sarah Julia Smith, [seal.]
O. C. Marsh, [seal N. A. S.]
President of the National Academy of Sciences.

Sealed and delivered in presence of Annie C. Norton, J. H. Caperton as to Sarah Julia Smith.

Witnesses to signature of President Marsh: George J. Brush, E. S. Dana.

The following resolutions were adopted:

Resolved, That the treasurer be authorized to reserve from the income of the J. Lawrence Smith fund one hundred and thirty-three dollars a year, to be invested from time to time until the invested fund is increased to eight thousand dollars, the amount intrusted to the academy by Mrs. Smith.

Resolved, That the National Academy of Sciences gratefully acknowledges the receipt of a fund of eight thousand dollars presented in trust by Mrs. Sarah Julia Smith to promote the study of meteoric bodies; that the academy adopts and confirms the action of its president in accepting such trust and promises the faithful execution of the same.

That the academy appreciates the confidence reposed by the donor in selecting it as the trustee for executing her purpose, and her further liberality in providing dies for a suitable medal.

That a committee of five members be appointed by the president to recommend to the academy such measures as may be necessary to the proper execution of the trust.

That the said committee be charged with the duty of preparing an expression of appreciation by the academy of the munificence of Mrs. Smith, and of having such expression suitably engrossed and signed by the proper officers for transmission to the donor.

STATED SESSION, APRIL 21–24, 1885—(Continued).

The treasurer made the following report:

Receipts:	
Cash received from Mrs. Smith	$8,000.00
Interest of investment	243.00
	8,243.00
Expenditures:	
Purchase of $7,200 United States 4.5 per cent bonds	8,073.00
Cash balance, April 20, 1885	170.00
	8,243.00

STATED SESSION, APRIL 17–20, 1888.

The committee on the J. Lawrence Smith medal submitted the following statement and recommendation:[a]

The deed of gift of the funds for this medal contains a provision "That the investigation for which it is awarded or the completed publication thereof shall have been made since the time of the last preceding award and presentation of the said medal."

We find that this provision restricts the consideration of works for which the medal may be awarded in a way and degree which we believe that the generous donor did not intend. Most great works of the present time have no definite time of ending, being continued from year to year, and seeing the light only in a series of publications, no one of which can be regarded as fully completing the work. In other cases the value of an epoch-making work may not be fully recognized at the time of making an award to some other work. In the first case an award would, as the provision now stands, be of questionable legality; in the second, entirely illegal.

Believing that this restriction upon the award will be recognized by the academy and by the donor as inexpedient, we recommend that the academy submit a statement of the case to Mrs. Smith, with the respectful request that she consider the expediency of modifying her deed of gift by annulling the provision above quoted.

The academy adopted a motion recommending that the donor of the fund be requested to cancel the following clause contained in the deed of gift:

That the investigation for which it is awarded, or the completed publication thereof, shall have been made since the time of the last preceding award and presentation of the said medal.

STATED SESSION, APRIL 21–24, 1891.

The following resolution was adopted:[b]

Resolved, That it is the opinion of the academy that the power to decide as to what investigations shall be made at the expense of the income of the J. Lawrence Smith fund can not be delegated by the academy, and that applications for aid from this fund should be forwarded to the academy by the standing committee on the fund, with its recommendation in each case.

STATED SESSION, APRIL 17–20, 1894.

The following letter was read:

YALE UNIVERSITY, *April 16, 1894.*

To the National Academy of Sciences.

GENTLEMEN: The board of managers of the Yale Observatory respectfully applies for an appropriation of $2,000 from the accumulated income of the J. Lawrence Smith fund. We propose, if the application is granted and the appropriation made, therewith to erect on the observatory grounds, and to enclose, an equatorial axis driven by first-class clockwork, and upon the axis to mount four or six cameras with a directing telescope, and therewith to photograph the tracks of shooting stars. Experiments made in August and December last gave us, in eighteen hours' exposure, six photographed tracks, and we believe that with a not unreasonable amount of labor we may obtain additional photographed tracks if such an instrument as is proposed shall be at our service. The best methods of observing hitherto devised are liable to errors measured by degrees, while photographed tracks may be measured with errors of small fractions of a minute.

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[a] Similar recommendations were made by the committee on the Henry Draper medal. (See p. 60.)

[b] A similar resolution was adopted concerning the Henry Draper fund. (See p. 60.)

For the board of managers.

H. A. Newton.

The appropriation was recommended by the chairman of the trustees of the Smith fund, and was approved by the academy.

ANNUAL MEETING, APRIL 21–23, 1908.

The treasurer made the following statement as to the present condition of the J. Lawrence Smith fund:

Capital account	$10,000.00
Invested income	830.07
Cash on hand	534.45

The committee reported that it had the manuscript of the introduction to the catalogue of the meteorites of North America; the catalogue describes 245 meteorites, of which 162 are irons, 10 are ironstones, and 73 are stones.

APPROPRIATIONS FROM THE J. LAWRENCE SMITH FUND.

April, 1894.	Yale Observatory	$2,000.00
	Apparatus to photograph shooting stars.	
April, 1898.	Yale Observatory	1,000.00
	Apparatus to photograph shooting stars.	
April, 1908.	O. C. Farrington	800.00
	Preparation of catalogue of meteorites.	

RECIPIENT OF J. LAWRENCE SMITH MEDAL.

1888. H. A. Newton. For investigation of the orbits of meteors.

COMMITTEES ON THE J. LAWRENCE SMITH FUND.

1885–1892.

Wolcott Gibbs.
G. J. Brush.
A. Hall.
R. Pumpelly.
L. M. Rutherford.

1893 and 1894.

Wolcott Gibbs.
G. J. Brush.
A. Hall.
R. Pumpelly.
Ira Remsen.

1895–1899.

G. J. Brush. A. Hall. S. W. Johnson.
R. Pumpelly. Ira Remsen.

1900–1905.

G. J. Brush. E. W. Morley. S. W. Johnson.
R. Pumpelly. Ira Remsen.

1906–1908.

E. W. Morley. E. S. Dana. S. W. Johnson.
R. Pumpelly. Ira Remsen

THE F. A. P. BARNARD MEDAL.

SPECIAL STATED SESSION, NOVEMBER 11, 1891.

The home secretary read the following letters and documents concerning the Barnard medal:

No. 67 Wall Street,
New York, November 7, 1891.

National Academy of Sciences.

Gentlemen: The Trustees of Columbia College, as residuary legatees and devisees of the late President Barnard, have accepted and undertaken to perform the trust created by his will, and have instructed me to communicate with you for the purpose of ascertaining your willingness to charge yourselves with the duty of declaring to the Trustees of Columbia College at the close of every term of five years the name of the person whom you judge worthy to receive the "Barnard Medal for Meritorious Service to Science."

I inclose herewith a copy of the portion of President Barnard's will relating to the medal referred to, together with a transcript from the minutes of the trustees.

Very respectfully, John B. Pine, *Clerk.*

EXTRACT FROM THE WILL OF F. A. P. BARNARD.

2. All the remainder of my property, invested as aforesaid, to constitute a fund, under the name of the "Barnard Fund," for the increase of the library, the income from the same to be devoted to the purchase on account of the Library of Columbia College of such books as from time to time may be most needed, but especially relating to physical or astronomical science, selecting, in preference, those which may be likely to be most useful to persons engaged in scientific investigation. But of the income from this said fund I desire that so much as may be necessary shall be applied in the manner following: The Trustees of Columbia College shall cause to be struck, with suitable devices, a medal of gold, nine-tenths fine, of the bullion value of not less than two hundred dollars, to be styled "The Barnard Medal for Meritorious Services to Science," and shall publicly announce that a copy of the same shall be awarded, at the close of every quinquennial period, dating from the probate of this my last will and testament, to such person, whether a citizen of the United States or of any other country, as shall, within the five years next preceding, have made such discovery in physical or astronomical science, or such novel application of sci-

ence to purposes beneficial to the human race, as, in the judgment of the National Academy of Sciences of the United States, shall be esteemed most worthy of such honor. And I make it my request that the said National Academy of Sciences shall charge itself with the duty of declaring to the Trustees of Columbia College, aforesaid, at the close of every term of five years, as above defined, the name of the person whom they judge worthy to receive such medal, with a statement of the reasons on which their judgment is founded; and that, upon such declaration and nomination, the Trustees shall proceed to award the said medal, and shall transmit the same to the person entitled to receive it, accompanied by a diploma or certificate attesting the fact and the occasion of the award. But if the said National Academy of Sciences shall judge that, during the five years preceding the date at which, as above provided, this award shall become due, no discovery in physical or astronomical science, or no new application of scientific principles to useful purposes, has been made worthy of the distinction proposed, then it is my wish and request the award shall be for that time omitted. And I would further desire that the medal above described should bear, if it can be accomplished without interfering with the appropriate artistic devices, upon its obverse side the motto, "Magna est Veritas," and upon its reverse the motto, "Deo optimo Maximo, Gloria in Excelsis."

At a meeting of the Trustees of Columbia College, held in the city of New York, November 2, 1891, the following action was taken:

Resolved, That the trustees accept with grateful appreciation the gifts of the late President Barnard, and undertake and agree to perform the trusts created by the will.

Resolved, That the remainder of the property bequeathed to the college by Doctor Barnard be set apart as a fund, to be known as the "Barnard Fund for the Increase of the Library;" that so much of the income of said fund as may be necessary be applied to the manufacture and supply once in every five years of a gold medal of the bullion value of not less than $200, to be known as the "Barnard Medal for Meritorious Service to Science," and that the remainder of the income of the said fund be applied to the purchase for the library of such books as from time to time may be most needed, but especially relating to physical or astronomical science, selecting in preference those which may be likely to be most useful to persons engaged in scientific investigation.

Resolved, That it be referred to the Committee on the Library to cause to be prepared and to submit a suitable design for such medal, the design conforming as nearly as practicable to the suggestions contained in the will.

Resolved, That one such medal be awarded at commencement at the close of every quinquennial period, dating from the 17th day of July, 1889, to such person, if any, whether a citizen of the United States or of any other country, as shall within the five years next preceding have made such discovery in physical or astronomical science or such novel application of science to purposes beneficial to the human race as in the judgment of the National Academy of Sciences of the United States shall be esteemed most worthy of such honor.

Resolved, That the clerk be instructed to transmit to the National Academy of Sciences a copy of that portion of the will of Doctor Barnard relating to the "Barnard Medal for Meritorious Services to Science," and to ascertain whether such Academy will charge itself with the duty of declaring to the Trustees at the close of every term of five years the name of the person whom they judge worthy to receive such medal.

The academy approved a recommendation from the council accepting the trust provided for in the will of Dr. F. A. P. Barnard.

The academy approved a recommendation from the council that a committee of five members be appointed to nominate to the academy from time to time the name of the person to be designated as the recipient of the Barnard medal.

RECOMMENDATIONS FOR THE BARNARD MEDAL.

1895. Lord Rayleigh. For his brilliant discovery of argon, a discovery which illustrates so completely the value of exact scientific methods in the investigation of the physical properties of matter.

1900. Wilhelm Conrad Röntgen. For his discovery of the X rays.

1905. Henri Becquerel. For his discoveries in the field of radio-activity.

COMMITTEES ON THE BARNARD MEDAL.

1891–1893.

C. F. Chandler. Lewis Boss. J. P. Cooke.
E. S. Dana. G. Brown Goode.

1894 and 1895.

C. F. Chandler. Lewis Boss. C. B. Comstock.
E. S. Dana. G. Brown Goode.

1896–1898.

C. F. Chandler. Lewis Boss. C. B. Comstock. E. S. Dana.

1899 and 1900.

J. S. Billings. H. P. Bowditch. S. C. Chandler. H. A. Rowland.
O. N. Rood. C. L. Jackson. S. Newcomb.

1901.

J. S. Billings. H. P. Bowditch. S. C. Chandler. O. N. Rood.
C. L. Jackson. S. Newcomb.

1902 and 1903.

J. S. Billings. H. P. Bowditch. S. C. Chandler. C. L. Jackson.
S. Newcomb. William Sellers.

1904.

J. S. Billings. H. P. Bowditch. S. C. Chandler.
C. L. Jackson. S. Newcomb.

1905–1908.

J. S. Billings. H. P. Bowditch. S. C. Chandler. C. L. Jackson.
S. Newcomb. E. L. Nichols.

THE WOLCOTT GIBBS FUND.

STATED SESSION, APRIL 19–22, 1892.

The president stated that when Mr. Wolcott Gibbs reached the age of 70 a number of friends presented him with $2,600, to establish a fund bearing the name of the recipient, the income to be devoted to aiding in the prosecution of chemical research. The following letter from Mr. Gibbs was read:

MY DEAR PROFESSORS JACKSON AND LOEB:

May I beg you to present to those from whom I received, a few days since, so signal a mark of friendship and good will my heartiest, most earnest, and most grateful acknowledgment? The address which I received on my seventieth birthday, signed by more than 100 friends, pupils, and assistants, brings back my youth in recalling the names of those who now join to offer me more than mere good wishes to cheer my advancing age. Their active friendship has taken the form which was most acceptable to me—that of an endowment to assist research in my own branch of science; so that I can feel that in a certain sense my power to work will not terminate with my life. As the generosity of my friends permits me also to dispose of the manner in which the endowment shall be administered, I submit to them, through you, the plan which seems to me best adapted to carry out their wishes—a plan which has been fully tested in somewhat similar cases and found to work well in practice.

I therefore propose that the fund raised for endowment shall be given to the National Academy of Sciences, to hold the same in trust and to invest and reinvest as may be necessary or advisable. The income or interest of the fund shall be administered by a board of directors consisting of three persons, of whom at least two shall be members of the academy. The first board shall consist of Charles Loring Jackson, Thomas M. Drown, and Ira Remsen, and the directors shall have power to fill vacancies in their own number, notifying the academy of their action without delay. In case of the deaths of all the members of the board, their places shall be filled by persons holding professorships of chemistry, to be appointed by a vote of the academy. The directors shall make an annual report to the academy, stating the condition of the fund and the appropriations made during the year. They shall have absolute and entire control of the disposition of the income of the fund, employing it in such manner as they may deem for the best interest of chemical science.

It is my belief that the above or a similar arrangement is the best which can be made—that is to say, the one which is most likely to be of permanent benefit to science. I trust that it will meet with the approbation of those who have honored me with their confidence and their regard.

Sincerely, yours, WOLCOTT GIBBS.

NEWPORT, *March 1, 1892.*

The following recommendation from the council was adopted by the academy:

That the academy accept the charge of the Wolcott Gibbs fund for the promotion of chemical research, subject to the conditions expressed in Doctor Gibbs's letter to the donors; also that it offer its congratulations to Doctor Gibbs on the well-merited honor which has been conferred upon him, and its acknowledgments to him for the confidence which he has manifested by his disposal of the fund.

ANNUAL SESSION, APRIL 18–21, 1893.

The treasurer's report contains the statement that the Wolcott Gibbs fund has been invested in the Williamson and Kimmel loan, at 5 per cent, and that it amounts to $2,673.17.

SPECIAL SESSION, NOVEMBER 8, 1893.

The trustees reported that the following action had been taken by them under date of June 15, 1892:

> That the annual income of the Wolcott Gibbs fund for chemical research be paid to Dr. Wolcott Gibbs, of Newport, during his life, to be used by him in whatever way will best promote his chemical investigations, and that the only vouchers required for the money shall be his receipts, sent to the treasurer of the National Academy of Sciences.

In accordance with the terms of this resolution, and of the conditions made by Doctor Gibbs, the income of the fund has been paid annually to Doctor Gibbs by the boards of direction of the Wolcott Gibbs fund.

BOARDS OF DIRECTORS OF THE WOLCOTT GIBBS FUND.

1892–1903.

C. L. Jackson. Ira Remsen. T. M. Drown.

1904.

C. L. Jackson. Ira Remsen.

1905–1908.

C. L. Jackson. Ira Remsen. Edgar F. Smith.

THE BENJAMIN APTHORP GOULD FUND.

SCIENTIFIC SESSION, NOVEMBER 16–18, 1897.

The president announced that Miss Alice Bache Gould, daughter of the distinguished astronomer, Benjamin Apthorp Gould, had presented to the academy the sum of $20,000 as a memorial of the life work of her father. The terms of the donation are stated in the two accompanying papers, one of which is the deed of trust and the other a detailed expression of the preference of the donor as regards the administration of the trust.

The president then read the following deed of trust from Alice Bache Gould, of Boston, Mass., to the National Academy of Sciences:

> Know all men by these presents that I Alice Bache Gould of the City of Boston and County of Suffolk, State of Massachusetts, in consideration of the acceptance of the within Trust by the National Academy of Sciences and also in consideration of divers other good and valuable considerations have given

granted assigned transferred and set over and by these presents do give grant assign transfer and set over unto the said National Academy of Sciences and its successors forever a certain fund or sum of twenty thousand (20,000) dollars with the interest and income thereof to have and to hold the same in trust nevertheless upon the special trusts and for the uses and purposes following, to wit:

First. In trust, to invest and reinvest the said sum of twenty thousand dollars ($20,000.) and to keep the same invested under the ordinary rules governing trustees in good and safe securities in such manner as shall be deemed best for the preservation and maintenance of such fund, which shall be known as the "Benjamin Apthorp Gould Fund," in memory of my father, the late Benjamin Apthorp Gould, of Cambridge, Massachusetts.

Second. In trust to use the net interest and income thereof according to and under the direction of Lewis Boss of Albany New York Seth C. Chandler of Cambridge Massachusetts and Asaph Hall of Washington D. C, whom I hereby constitute a Board of Directors for the application of the income of the said Benjamin Apthorp Gould Fund, for the prosecution of researches in astronomy, by assisting such observers and investigators in such manner and in such sums as shall be agreed upon by the three above-mentioned persons or their successors or by a majority of the then Board.

The Board of Directors however instead of expending all the income of the Fund for the purposes aforesaid may from time to time vote that such portions thereof as they may prescribe shall be added to the principal of the said Fund, and such portion shall then be so added by the Trustees and all such sums once so added shall remain part of the principal.

The Board of Directors shall make an annual report to the National Academy of Sciences giving such information concerning the Fund as shall be desired by the said Academy.

In case of any vacancy occurring in the Board of Directors by reason of the death, inability or refusal to act or resignation of any of its members, then the surviving or remaining members or member for the time being shall have power to fill any vacancy so occurring in the Board by the selection of another person or persons to fill the same, and so on from time to time as vacancies shall occur provided however that at least two of the three directors shall always be members of the National Academy of Sciences. But if at any time the three Directorships of the Board shall simultaneously be vacant, then the National Academy of Sciences shall have power to fill these vacancies and the new Board of Directors in this as in all other cases shall succeed to all the rights duties and privileges of the former board.

Provided however that if at any time the said Academy from any cause whatever shall cease to exist or in case at any time any modification of its rights or powers shall be made by any action other than that of the said Academy itself and such modification shall be followed within six months thereafter by a vote of the then Board of Directors approving the passing and transfer hereinafter mentioned, then and in all of such cases the said Fund together with all accumulations and unexpended income thereof shall pass and be transferred to the said Board of Directors who shall thereafter exercise the functions of both Directors and Trustees, and the said National Academy shall no longer thereafter act as Trustee, and shall have no power of appointing Directors and none of the Directors need be members of the said National Academy; and furthermore after such transfer and passing the said Directors may at any time appoint any other persons or corporation as Trustees, reserving to themselves their powers and duties as Directors, and the Fund shall thereupon pass to such new Trustees to be held upon the same trusts upon which it is hereby given to the National Academy of Sciences, the principal with its accumulations to be always held intact and the income applied as shall be best for the advancement of astronomy and for the honor of my father's memory.

And the said National Academy of Sciences doth hereby signify its acceptance of the said Fund of twenty thousand dollars ($20,000.) and doth engage to hold the same upon the trusts and conditions, and for the uses and purposes herein mentioned and set forth.

In witness whereof I the said Alice Bache Gould have hereto set my hand and seal and the said National Academy of Sciences has caused its corporate name and seal to be hereto affixed by Wolcott Gibbs its President thereunto duly authorized this seventeenth (17th) day of November in the year eighteen hundred and ninety seven (1897).

ALICE BACHE GOULD. [SEAL.]
WOLCOTT GIBBS.
President of the National Academy of Sciences.

W. W. Vaughan, witness to Alice Bache Gould.
O. C. Marsh, witness to Wolcott Gibbs.
J. M. Crafts, witness to Wolcott Gibbs.
C. B. Comstock, witness to Wolcott Gibbs.

We hereby accept our appointment to the Board of Directors above constituted.

LEWIS BOSS.
SETH C. CHANDLER.
ASAPH HALL.

Witnesses for directors: George F. Barker, Edw. S. Morse, Henry B. Hill.

To The BOARD OF DIRECTORS OF THE BENJAMIN APTHORP GOULD FUND.

GENTLEMEN: Believing that elaborate legal restrictions upon the uses of a perpetual fund may often under changing circumstances hinder the accomplishment of the general intention of the donor, I have in the deed creating the Benjamin Apthorp Gould Fund defined its uses as briefly as possible, namely, as "for the prosecution of researches in astronomy."

Nevertheless I wish hereby to record with you some personal preferences, based upon what I believe would have been my father's opinions regarding the best use of such a Fund, expressly stating however that this letter is not intended to restrict the action of the Board of Directors more than shall in their judgment be expedient and fitting.

First. My object in creating the Fund is two-fold; on the one hand to advance the science of astronomy, and on the other to honor my father's memory and to insure that his power to accomplish scientific work shall not end with his own life.

Second. Throughout my father's lifetime his patriotic feeling and scientific ambition were closely associated, and I wish therefore that a fund bearing his name should be used primarily for the benefit of investigators in his own country or of his own nationality. I recognize however that sometimes the best possible service to American science is the maintenance of close communion between the scientific men of Europe and of America and that therefore even while acting in the spirit of the above restriction it may occasionally be best to apply this money to the aid of a foreign investigator working abroad.

In connection with this I must refer to the strong interest felt by my father in the National Academy of Sciences, and to his belief in the importance of creating and maintaining a single national scientific body whose preeminence should be unquestionable, and of concentrating power in its hands. I wish to recommend that all three Directors shall be members of the Academy, although I have made this legally necessary for only two of the three, and to record the desire to serve the Academy so far as I am able as one of my minor motives in creating the Trust.

Third. I have copied many of the provisions of the Bache Fund, and it is my hope that the Boards of Direction of the two Funds may always act in friendly unison, as befits the long and intimate friendship of the men whose work they perpetuate. I trust that the new Fund may relieve the Bache Directors of many astronomical expenses, and thus enable them to devote the same amounts of money to other branches of science. And I recommend the adoption of a custom now followed by the Bache Board of Directors, by which each Director upon his own election names to his colleagues the person whom he believes most fit to succeed him.

Fourth. I wish that in all cases work in the Astronomy of Precision should be distinctly preferred to any work in Astrophysics, both because of my father's personal preference and because of the present existence of generous endowments for Astrophysics.

Fifth. The Astronomical Journal long conducted by my father has in my belief exerted a powerful influence in raising the standard of American astronomy; and in case at some future time its existence should be imperiled by lack of funds, I wish to recommend it to the attention of the then Board of Directors. As however I believe that the granting to any scientific journal of definite rights over such a Fund would be a dangerous precedent, I here repeat that the Directors are not to consider themselves bound by these my present wishes further than they deem appropriate in connection with a journal associated with my father's name.

Sixth. The Benjamin Apthorp Gould fund is intended for the advancement and not for the diffusion of scientific knowledge. Moreover I prefer that it should be used to defray the actual expenses of an investigation rather than for the personal support of the investigator during the time of his researches. I do not wish absolutely to exclude the latter important use, but such an employment of funds seems to me more appropriately the function of a university than of the National Academy, and I hope therefore that before granting money for such a purpose the Directors will consider the existing university endowments and other sources of pecuniary aid for able workers in science.

Finally I wish to express my entire faith in the wise judgment of the first Board of Directors and my sense of my own good fortune in being able to intrust a memorial of my father to the hands of men who have been both his scientific associates and his intimate personal friends.

ALICE BACHE GOULD.

BOSTON, *November 17, 1897.*

The deed of trust was then formally accepted by the academy, and the president was requested to prepare a letter of acknowledgment to be engrossed and forwarded to Miss Gould.

ANNUAL MEETING, APRIL 16-18, 1901.

The directors of the Benjamin Apthorp Gould fund reported that in accordance with the vote of the academy, April 19, 1899, they had prepared the following report of progress of all the work which they have encouraged, so far as such a report was practicable at the present time:

Appropriation No. 1, to C. L. Doolittle, $500, March 28, 1899.

A computer was at work during the greater part of the year ending July 1, 1900. Although not completed at that time, the final reduction was so far advanced that the first installment of the work at Bethlehem on the variation of latitude and aberration was soon ready for the printer, and is now in process of publication by the American Philosophical Society of Philadelphia. It is hoped that the remainder will be in shape during the current summer and printed about one year from the present date.

Appropriation No. 2, to Mr. Henry M. Parkhurst, $300, March 25, 1899.

About two-thirds of the sum advanced was used for reconstruction of observatory and instruments and the remainder in instrumental improvements. The work done in the observations of variable stars has been printed in five communications to the Astronomical Journal, and the continuation to date is nearly ready for printing. It is to be indefinitely continued in the future.

Besides this the work on the photometric observation of the asteroids has been continuously prosecuted to date, and especially those relating to Eros, which series already covers more than six months, and is ready for publication.

Appropriation No. 3, to John A. Parkhurst, $30, April 18, 1900.

Money expended in purchase of the first two parts of Hagen's Atlas of Variable Stars, to be used in conjunction with the 40-inch refractor of the Yerkes Observatory, Chicago, for the observation of the minima of the fainter variables. A specific account of the progress of this work has not yet been called for by the board.

Appropriation No. 4, to Dr. Herman S. Davis, $500, April 18, 1900.

A detailed report of the work done to date has been received by the board. The money has been used for the computation of the refractions and the reductions to apparent place, and enough of the appropriation is in hand to complete the computation of the refractions.

(Appropriations Nos. 5 and 6 being quite recent, the board deems it too early to make a specific report with regard to them.)

ANNUAL MEETING, APRIL 15–17, 1902.

The directors of the Benjamin Apthorp Gould fund reported that they had entered into the following agreement for a deferred appropriation:

Dr. Herman S. Davis:

We agree to pay you the sum of $2,500 in a warrant for that amount drawn upon the treasurer of the National Academy of Sciences, upon the receipt from you, on or before January 1, 1910, either of a printed copy of the final results of your "New Reduction of Piazzi", or on the deposit by you of a manuscript copy of the same, ready for printing, with the National Academy of Sciences.

A further condition of this grant is that you inform us two years in advance of the date when such copy is likely to be ready, on the receipt or deposit of which, as above stated, the payment herein promised will be due.

Asaph Hall,
Seth C. Chandler,
Lewis Boss,
Board of Directors of the Benjamin Apthorp Gould Fund.

August 1, 1901.

They also reported that for the establishment of a sinking fund, principally to meet this liability, they had authorized the treasurer to transfer the sum of $1,000 from the cash income account to an invested income account.

ANNUAL MEETING, APRIL 19–21, 1904.

The directors of the Benjamin Apthorp Gould fund gave the following summary of the operation of the fund from its foundation, in November, 1897:

Receipts of net income from November, 1897, to April, 1903		$4, 440. 81
Estimated accrued income for year 1903–4, about		900. 00
		5, 340. 81
Total expended for scientific investigation, as shown by the several reports of the directors to date, including outstanding obligations	$4, 378. 85	
Income invested as a sinking fund toward meeting an additional, deferred, and contingent grant of $2,500 to H. S. Davis	1, 000. 00	
		5, 378. 85
Excess of appropriations over income to April, 1904		38. 04

ANNUAL MEETING, APRIL 18–20, 1905.

The directors of the Benjamin Apthorp Gould fund reported that they had authorized the treasurer to carry the sum of $500 from the cash income account to the invested income account as an addition to the sinking fund toward meeting the deferred contingent grant of $2,500 to Dr. H. S. Davis.

ANNUAL MEETING, APRIL 21–23, 1908.

The treasurer reported that the capital of the Benjamin Apthorp Gould fund remains unchanged at $20,000.

APPROPRIATIONS MADE FROM GOULD FUND.

	1899.	
Mar. 25.	Henry M. Parkhurst Photometric stellar observations.	$300. 00
Mar. 28.	C. L. Doolittle (1) Reduction of latitude observations.	500. 00
	1900.	
Apr. 18.	Herman S. Davis (1) Reduction of Piazzi's observations.	500. 00
Apr. 18.	John A. Parkhurst Purchase of books to be used in investigation of variable stars.	30. 00
Dec. 15.	Paul S. Yendell (1) Investigation of variable stars. (January 21, 1902, $63.45 of this amount was returned unexpended, and June 15, 1903, $12.30 was reappropriated, as below.)	225. 00

1901.

Feb. 1.	Simon Newcomb Investigation on planes of the galaxy and bright stars.	$25.00
—— —.	Appropriation for the purpose of bringing up the arrears of cometary research, offered to American astronomers for computation of definitive orbits of certain comets, to be distributed among the computers taking part in the work, the relative apportionment to be hereafter determined by the board	500.00
Nov. 4.	Herman S. Davis (2) Reduction of Piazzi's observations.	500.00
Aug. 1.	Agreement for deferred appropriation of $2,500 to Dr. Herman S. Davis (3) for results of his "New reduction of Piazzi" on or before January 1, 1910	2,500.00

1902.

Feb. 1.	W. W. Payne (1) Measurement of photographs of planet Eros. (This appropriation afterwards divided into appropriations of $150 each to Carleton College Observatory and Prof. F. P. Leavenworth (1).)	300.00
Dec. 30.	H. A. Pack (1) Computations of cometary orbits.	100.00

1903.

Mar. —.	Offer of $500 to American astronomers for computation of definite orbits of comets, renewed	500.00
Apr. 14.	W. W. Payne (2) Measurement of photographs of planet Eros.	250.00
Apr. 14.	F. P. Leavenworth (2) Measurement of photographs of planet Eros.	200.00
Apr. 14.	George C. Comstock Reduction of A. S. Flint's meridian observations.	400.00
May 13.	Charles L. Doolittle (2) Variation of latitudes.	1,000.00
June 15.	Paul S. Yendell (2) Reappropriation of portion of amount returned on January 21, 1902.	12.30

1904.

Mar. 18.	H. A. Pack (2) Computation of cometary orbit.	100.00

1906.

Mar. 6.	Charles L. Doolittle (3) Investigation with zenith telescope.	500.00

1908.

Jan. 4.	Charles L. Doolittle (4) Investigation on variation of latitude.	1,000.00

BOARDS OF DIRECTION, BENJAMIN APTHORP GOULD FUND.

1897–1906.

Asaph Hall.	S. C. Chandler.	Lewis Boss.

1907 and 1908.

Lewis Boss.	S. C. Chandler.	G. W. Hill.

THE CYRUS B. COMSTOCK FUND.

BUSINESS MEETING, NOVEMBER 20, 1907.

The president announced that Gen. Cyrus B. Comstock had presented to the academy the generous gift of $10,000, the interest of said fund to be devoted to the advancement of knowledge in electricity, magnetism, and radiant energy.

The terms of the deed of gift, dated November 27, 1907, are as follows:

Know all men by these presents, that I, Cyrus B. Comstock, of the City of New York, to advance knowledge in electricity, magnetism and radiant energy, by the giving of money prizes for important investigations or discoveries in those subjects, have given, assigned, transferred and set over, and do by these presents give, assign, transfer and set over unto the National Academy of Sciences, incorporated by the Act of Congress approved March 3rd, 1863, and its several supplements, and hereinafter designated as the Trustee, and unto its successor or successors, ten (10) Union Pacific Railroad Company Registered First Mortgage and Land Grant Four Per Cent Gold Bonds, Numbers B 588, B 663, B 993, B 994, B 1106, B 1204, B 1282, B 1290, B 1309, B 1369, each for $1,000, and my check for Four hundred Dollars ($400.00), bearing even date herewith and payable to the order of the National Academy of Sciences.

To have and to hold the same unto the said National Academy of Sciences, its successor or successors in trust and upon the following conditions, to wit:

First. The Trustee shall keep said sum of Four hundred Dollars ($400.00), and said bonds, or the proceeds thereof and all additions thereto, as a separate fund, to be known as the "Cyrus B. Comstock Fund."

Second. The Trustee shall have power at any time in its discretion to sell said bonds or any of them and execute a proper assignment thereof to the purchaser or purchasers, and shall invest the proceeds thereof and all moneys forming a part of said fund, and keep the same invested in such securities and in such manner as its constitution shall provide for the investment of its property or as shall be authorized by law for the investment of trust funds.

Third. The Trustee shall collect the income arising from said fund and apply the same as follows:

(1) The market value of the fund shall be maintained at not less than Ten thousand Dollars ($10,000), and any and all depreciation therein shall be made up out of the income of the fund before any part of such income shall be applied as hereinafter provided. But when, by the additions hereinafter authorized and directed, the principal of the fund shall have been increased in the amount of Five thousand Dollars ($5,000.), then and thereafter the market value of the fund shall be maintained in the manner aforesaid at not less than Fifteen thousand Dollars ($15,000.).

(2) The balance of the income of said fund shall be set aside and accumulated, and out of such accumulations the Trustee shall award once for every five years a prize in money to the bona fide resident of North America, who, not less than one year nor more than six years before the awarding of the prize, shall have made in the judgment of the Trustee the most important discovery or investigation in electricity or magnetism or radiant energy.

Such prize shall be known and designated as the "Comstock Prize," and shall be in an amount equal to about two-thirds of said balance of the income of said fund for the five years for which the award shall be made, and shall be paid to the person to whom the prize shall have been awarded at such time as may be convenient to the Trustee, but the awarding thereof shall be entirely and in all respects in the discretion of the Trustee. If no such discovery or investigation shall be deemed by the Trustee to be worthy of the prize, or if for any other reason the prize shall not be awarded for any period of five years, then and in that event the money which might have been awarded shall be added to the principal of the fund and become a part thereof; but the Trustee may in its discretion use the whole or any part of the amount unawarded for any five years in aiding such investigation or investigations as the Trustee shall deem worthy in electricity, magnetism or radiant energy to be made by a bona fide resident or residents of North America; Provided, however, that the prize shall not be diverted to give such aid oftener than once in fifteen years.

(3) The balance of the income so accumulated, less the amount to be awarded as a prize, as provided in the preceding section, shall be added to the principal of the fund and become a part thereof and subject to the terms and conditions herein contained, as though such additions had been part of the original donation; Provided, however, that when the market value of said fund shall have been increased to Fifteen thousand Dollars ($15,000.), the amount of the prize may be increased in the discretion of the Trustee to more than two-thirds of the net income as above provided.

Fourth. Upon the failure or inability of the Trustee, its successor or successors, to carry out the said trust upon the terms and conditions above set forth, said fund together with all accumulations and unexpended income shall revert to me, the said Cyrus B. Comstock, if then living; if dead, to my heirs-at-law who shall then be living, per stirpes and not per capita.

In witness whereof, I, the said Cyrus B. Comstock, have hereunto and unto a duplicate hereof, set my hand and seal this twenty-seventh day of November, one thousand nine hundred and seven.

CYRUS B. COMSTOCK.

Sworn and subscribed before Monchure March, notary public, in the city and county of New York, November 27, 1907.

Know all men by these presents that the National Academy of Sciences, the Trustee named in the foregoing instrument, hereby acknowledges the receipt from the said Cyrus B. Comstock of said ten (10) Union Pacific Railroad Company Registered First Mortgage Railroad and Land Grant Four Per Cent Gold Bonds, Numbers B 588, B 663, B 993, B 994, B 1106, B 1204, B 1282, B 1290, B 1309, B 1369 each for $1,000, duly assigned to the said National Academy of Sciences as Trustee under the foregoing instrument, and his check for Four hundred Dollars ($400.00), payable to the order of the National Academy of Sciences; and that, by authority of its Council, the said Trustee hereby accepts and agrees to hold the same in trust and upon the terms and conditions above set forth.

And the said National Academy of Sciences hereby constitutes and appoints Ira Remsen its true and lawful attorney, for it and in its name to acknowledge this instrument, and a duplicate hereof, to be its act before any person having authority to take such acknowledgment.

In witness whereof, the said the National Academy of Sciences has caused its corporate seal to be hereunto and unto a duplicate hereof affixed, and these presents, and a duplicate hereof, to be signed in its name by its President and Treasurer this thirtieth day of November, one thousand nine hundred and seven.

NATIONAL ACADEMY OF SCIENCES.
By IRA REMSEN, *President.*
S. F. EMMONS, *Treasurer.*

Sworn and subscribed before John R. Hooper, notary public, in the city of Baltimore, State of Maryland, December 4, 1907.

COMMITTEE ON THE COMSTOCK TRUST FUND.

1908.

E. L. Nichols.
A. A. Noyes.
Elihu Thomson.
Geo. E. Hale.
A. G. Webster.

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907; November 20, 1907.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

SEC. 3. The academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six

years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the academy until the next stated session of the academy.

Sec. 2. The officers of the academy, together with six members to be elected by the academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the academy.

Sec. 3. The president of the academy, or, in case of his absence or inability to act, the vice-president, shall preside at the meetings of the academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its sessions next ensuing; and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

Sec. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

Sec. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

Sec. 1. The academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the first stated session in each year.

SEC. 4. Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the subject in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

SEC. 5. The academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Election to membership shall be held as described below. There shall be two ballots—a preference ballot, which may be prepared either before or at the meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

1. *Preference ballot.*—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

2. *Final ballot.*—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 20 votes in all, provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so one until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

Election of members shall be held at the regular stated session of each year held in Washington, and not more than 10 members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

Sec. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

Sec. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council and may be elected at the regular stated session of each year, held in Washington, by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.

Recommendations for nomination of foreign associates may be sent to the home secretary at any time.

Sec. 8. A diploma, with the corporate seal of the academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

Sec. 9. Resignations shall be addressed to the president and acted on by the academy.

Sec. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

Sec. 1. Communications on scientific subjects shall be read at scientific meetings of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

Sec. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

Sec. 3. The academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

Sec. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated session.

Sec. 5. The advice of the academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

Sec. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated sessions.

Sec. 7. Medals and prizes may be established, and the means of bestowing them accepted by the academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the academy, in stocks of the United States, or, with the approval of the council, in state bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the academy.

SEC. 2. No contract shall be binding upon the academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the academy shall be fixed by the academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee to be appointed by the president at or before the annual meeting. This committee shall also inspect and verify the bonds, securities, and other property in the custody of the treasurer. The report of this committee shall be presented to the academy before the close of the session.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the academy.

X. Memoirs shall date, in the records of the academy, from the date of their presentation to the academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the academy as early as practicable, and not later than the next stated session.

XII. The annual report of the academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make

scientific investigations at the request of departments of the Government, and in each case to look to the department requesting the investigation for reimbursement to the academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. At least sixty days before the election the members signing the nomination should furnish the home secretary with a sufficient number of printed copies of a list of the more important original works of the nominee to enable the secretary to furnish a copy to each member of the academy.

XIX. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XX. All discussions as to the claims and qualifications of nominees at meetings of the academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the academy at the time of the discussion.

XXI. Any rule of the academy may be amended, suspended, or repealed, on the written motion of any two members, signed by them, and presented at a stated session of the academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1908–9.

	Expiration of term.
Remsen, Ira, *President*	April, 1913
Walcott, C. D., *Vice-President*	April, 1913
Newcomb, Simon, *Foreign Secretary*	April, 1909
Hague, Arnold, *Home Secretary*	April, 1913
Emmons, S. F., *Treasurer*	April, 1914

ADDITIONAL MEMBERS OF COUNCIL.

1907–1909.

Agassiz, Alexander.
Woodward, R. S.

1907–1910.

Hale, George E.
Osborn, Henry F.

1908–1911.

Welch, W. H.
Wilson, E. B.

COMMITTEES OF THE ACADEMY.

ON NOMINATION OF NEW MEMBERS.

1. Mathematics and Astronomy.
    - Abbe, C.
    - Boss, Lewis.
    - Campbell, W. W.
    - Chandler, S. C.
    - Comstock, G. C.
    - Davidson, G.
    - Elkin, W. L.
    - Frost, E. B.
    - Hale, G. E.
    - Hill, G. W.
    - Holden, E. S.
    - Moore, E. H.
    - Newcomb, S. (Chairman).
    - Osgood, W. F.
    - Peirce, C. S.
    - Pickering, E. C.
    - Story, W. E.
    - Webster, A. G.
    - Woodward, R. S.
2. Physics and Engineering.
    - Abbe, C.
    - Abbot, H. L.
    - Barker, G. F.
    - Barus, C.
    - Bell, A. G.
    - Comstock, C. B.

2. Physics and Engineering—Cont'd.
    - Hastings, C. S.
    - Mendenhall, T. C.
    - Michelson, A. A.
    - Morley, E. W.
    - Nichols, E. F.
    - Nichols, E. L.
    - Noyes, A. A.
    - Peirce, B. O.
    - Pickering, E. C.
    - Pupin, M. I.
    - Thomson, Elihu.
    - Trowbridge, J.
    - Webster, A. G.
    - Woodward, R. S. (Chairman).
    - Wright, A. W.
3. Chemistry.
    - Barker, G. F.
    - Brush, G. J.
    - Chandler, C. F.
    - Chittenden, R. H.
    - Crafts, J. M.
    - Dana, E. S.
    - Gooch, F. A.
    - Hilgard, E. W.
    - Hillebrand, W. F.

3. Chemistry—Continued.
   - Jackson, C. L.
   - Johnson, S. W.
   - Michael, A.
   - Morley, E. W.
   - Morse, H. N.
   - Nef, John U.
   - Noyes, A. A. (Chairman).
   - Remsen, Ira.
   - Richards, T. W.
   - Smith, E. F.
   - Wells, H. L.
4. Geology and Paleontology.
   - Agassiz, A.
   - Becker, G. F.
   - Branner, J. C.
   - Chamberlin, T. C.
   - Clark, W. B.
   - Cross, Whitman.
   - Dall, W. H.
   - Davis, W. M.
   - Dutton, C. E.
   - Emmons, S. F.
   - Gilbert, G. K.
   - Hague, Arnold (Chairman).
   - Iddings, J. P.
   - Osborn, H. F.
   - Pumpelly, R.
   - Scott, W. B.
   - Van Hise, C. R.
   - Walcott, C. D.
   - White, C. A.
5. Biology.
   - Agassiz, A.
   - Allen, J. A.
   - Bowditch, H. P.
   - Brewer, W. H.
   - Chittenden, R. H. (Chairman).
   - Conklin, E. G.
   - Councilman, W. T.

5. Biology—Continued.
   - Dall, W. H.
   - Farlow, W. G.
   - Gill, T. N.
   - Goodale, G. L.
   - Howell, W. H.
   - Mall, F. P.
   - Mark, E. L.
   - Merriam, C. H.
   - Minot, C. S.
   - Morse, E. S.
   - Osborn, H. F.
   - Prudden, T. M.
   - Putnam, F. W.
   - Sargent, C. S.
   - Smith, Theobald.
   - Scudder, S. H.
   - Trelease, William.
   - Verrill, A. E.
   - Walcott, C. D.
   - Welch, W. H.
   - White, C. A.
   - Whitman, C. O.
   - Wilson, E. B.
   - Wood, H. C.
6. Anthropology.
   - Billings, J. S. (Chairman).
   - Boas, Franz.
   - Cattell, J. McK.
   - Flexner, Simon.
   - Holmes, W. H.
   - James, Wm.
   - Merriam, C. H.
   - Minot, C. S.
   - Mitchell, S. W.
   - Morse, E. S.
   - Peirce, C. S.
   - Putnam, F. W.
   - Royce, Josiah.
   - Welch, W. H.

ON WEIGHTS, MEASURES, AND COINAGE.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Newcomb, S.
Morley, E. W.
Peirce, C. S.
Comstock, C. B.
Woodward, R. S.

ON THE ELECTION OF FOREIGN ASSOCIATES.

Remsen, Ira, *Chairman.*
Mitchell, S. W.
Newcomb, S.
Brush, G. J.
Osborn, H. F.

ON PUBLICATION.

The President.
The Home Secretary.
Walcott, C. D.

ON SOLAR RESEARCH.

Hale, George E., *Chairman.*
Michelson, A. A.
Comstock, G. C.
Campbell, W. W.
Nichols, E. L.

TRUST FUNDS.

BOARD OF DIRECTION OF THE BACHE FUND.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Chandler, S. C., *Chairman.*
Remsen, Ira.
Minot, C. S.

BOARD OF TRUSTEES OF THE WATSON FUND.

[1883, residual estate, $18,666.88.]

For the promotion of astronomical research.

Newcomb, S., *Chairman.*
Elkin, W. L.
Boss, Lewis.

THE HENRY DRAPER FUND.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Newcomb, S., *Chairman.*
Trowbridge, John.
Wright, A. W.
Hale, G. E.
Michelson, A. A.

THE J. LAWRENCE SMITH FUND.

[1885, $8,000.]

For the investigation of meteoric bodies.

Morley, E. W., *Chairman.*
Johnson, S. W.
Pumpelly, R.
Dana, E. S.
Remsen, Ira.

THE BENJAMIN APTHORP GOULD FUND.

[1897, $20,000.]

For researches in astronomy.

Boss, Lewis, *Chairman.*
Chandler, S. C.
Hill, G. W.

THE BARNARD MEDAL.[a]

For meritorious service to science.

Billings, J. S., *Chairman.* **Jackson, C. L.** **Newcomb, S.**
Bowditch, H. P. **Chandler, S. C.** **Nichols, E. L.**

THE WOLCOTT GIBBS FUND.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman.* **Remsen, Ira.** **Smith, Edgar F.**

THE COMSTOCK TRUST FUND.

[1907, $10,000.]

For researches in electricity, magnetism, and radiant energy.

Nichols, E. L., *Chairman.* **Noyes, Arthur A.** **Thomson, Elihu.**
Hale, Geo. E. **Webster, A. G.**

JOSEPH HENRY FUND.

To assist meritorious investigators, especially in the direction of original research.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, JANUARY 31, 1909.

		Date of election.
Abbe, Cleveland	*U. S. Weather Bureau, Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley st., Cambridge, Mass.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum, New York City.*	1876

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[a] The Barnard medal fund is administered by the trustees of Columbia College, New York. This committee nominates the recipient to the National Academy, which declares the name of that person to the said trustees (See p. 67.)

		Date of election.
Barker, George F	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Brown University, Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Bowditch, Henry P	*Harvard Medical School, Boston, Mass.*	1887
Branner, John C	*Stanford University, California.*	1905
Brewer, William H	*418 Orange st., New Haven, Conn.*	1880
Brush, George J	*14 Trumbull st., New Haven, Conn.*	1868
Campbell, William W	*Lick Observatory, Mt. Hamilton, California.*	1902
Cattell, James McK	*Garrison, N. Y.*	1901
Chamberlin, Thomas C	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F	*Columbia University, New York City.*	1874
Chandler, Seth C	*Box 216, Wellesley Hills, Mass.*	1888
Chittenden, Russell H	*Sheffield Scientific School, New Haven, Conn.*	1890
Clark, W. B	*Johns Hopkins University, Baltimore, Md.*	1908
Comstock, Cyrus B., U. S. A	*124 E. Twenty-seventh st., New York City.*	1884
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Conklin, E. G	*Princeton, N. J.*	1908
Councilman, Wm. T	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M	*59 Marlborough st., Boston, Mass.*	1872
Cross, Whitman	*U. S. Geological Survey, Washington, D. C.*	1908
Dall, William H	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S	*Yale University, New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Davis, William Morris	*17 Francis ave., Cambridge, Mass.*	1904
Dutton, Clarence E., U. S. A	*Englewood, N. J.*	1884
Elkin, William L	*Yale University Observatory, New Haven, Conn.*	1895
Emmons, Samuel F	*U. S. Geological Survey, Washington, D. C.*	1892
Farlow, W. G	*Harvard University, Cambridge, Mass.*	1879
Flexner, Simon	*Rockefeller Institute, New York City.*	1908
Frost, Edwin B	*Yerkes Observatory, Williams Bay, Wis.*	1908
Gilbert, Grove K	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A	*Yale University, New Haven, Conn.*	1897
Goodale, George L	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E	*Solar Observatory, Mount Wilson, Cal.*	1902
Hastings, Charles S	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W	*University of California, Berkeley, Cal.*	1872
Hill George W	*West Nyack, N. Y.*	1874
Hillebrand, William F	*Bureau of Standards, Washington, D. C.*	1908
Holden, Edward S	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H	*Bureau of American Ethnology, Washington, D. C.*	1905
Howell, William H	*Johns Hopkins University, Baltimore, Md.*	1905
Iddings, Joseph P	*University of Chicago, Chicago, Ill.*	1907
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
James, William	*95 Irving st., Cambridge, Mass.*	1903
Johnson, Samuel W	*54 Trumbull st., New Haven, Conn.*	1866

		Date of election.
Mall, Franklin P.	*Anatom. Lab., Sta. O, Baltimore, Md.*	1907
Mark, Edward L.	*109 Irving st., Cambridge, Mass.*	1903
Mendenhall, Thomas C.	*Worcester, Mass.*	1887
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A.	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S.	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H.	*University of Chicago, Chicago, Ill.*	1901
Morley, Edward W.	*West Hartford, Conn.*	1897
Morse, Edward S.	*P. O. Box 268, Salem, Mass.*	1876
Morse, Harmon N.	*Johns Hopkins University, Baltimore, Md.*	1907
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Newcomb, Simon, U. S. N.	*1620 P st. NW., Washington, D. C.*	1869
Nichols, Edward L.	*Cornell University, Ithaca, N. Y.*	1901
Nichols, Ernest F.	*Columbia University, New York City.*	1908
Noyes, Arthur A.	*Massachusetts Institute of Technology, Boston, Mass.*	1905
Osborn, H. F.	*American Museum of Natural History, New York City.*	1900
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Benjamin O.	*Harvard University, Cambridge, Mass.*	1906
Peirce, Charles S.	*Milford, Pa.*	1876
Pickering, Edward C.	*Harvard College Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Pupin, Michael I.	*Columbia University, New York City.*	1905
Putnam, Frederick W.	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W.	*Harvard University, Cambridge, Mass.*	1899
Royce, Josiah	*Harvard University, Cambridge, Mass.*	1906
Sargent, Charles S.	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scott, William B.	*Princeton University, Princeton, N. J.*	1906
Scudder, Samuel H.	*Cambridge, Mass.*	1877
Smith, Edgar F.	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Theobald	*Harvard Medical School, Boston, Mass.*	1908
Story, William E.	*Clark University, Worcester, Mass.*	1908
Thomson, Elihu	*Swampscott, Mass.*	1907
Trelease, Wm.	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise C. R.	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E.	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D.	*Smithsonian Institution, Washington, D. C.*	1896
Webster, Arthur G.	*Clark University, Worcester, Mass.*	1903
Welch, William H.	*807 St. Paul st., Baltimore, Md.*	1895
Wells, Horace L.	*Yale University, New Haven, Conn.*	1903
White, Charles A.	*1908 13th st. NW., Washington, D. C.*	1889
Whitman, Charles O.	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B.	*Columbia University, New York City.*	1899
Wood, Horatio C	*4107 Chester ave., Philadelphia, Pa.*	1879
Woodward, Robert S.	*Carnegie Institution, Washington, D. C.*	1896
Wright, Arthur W.	*Yale University, New Haven, Conn.*	1881

HONORARY MEMBER.

		Date of election.
Smith, Sidney I.	*Yale University, New Haven, Conn.*	1884

FOREIGN ASSOCIATES.

Arrhenius, S. A.	*Nobelinstitut, Stockholm.*	1908
Auwers, Arthur	*Königl. Akad. der Wissenschaften, Berlin.*	1883
Backlund, Oskar	*Astron. Sternwarte, Pulkowo.*	1903
Baeyer, Adolph Ritter von	*Universität, Munich.*	1898
Barrois, Charles	*Université, Lille.*	1908
Bornet, Edouard	*Paris.*	1901
Brögger, W. C.	*Universitet, Christiania.*	1903
Darwin, Sir George Howard	*Newnham Grange, Cambridge.*	1904
Dewar, Sir James	*University, Cambridge.*	(?)
Ehrlich, Paul	*Königl. Inst. für Exper. Therapie, Frankfurt a. Main.*	1904
Fischer, Emil	*Chemisches Inst. der Universität, Berlin.*	1904
Forsyth, A. R.	*Trinity College, Cambridge.*	(?)
Geikie, Sir Archibald	*Haslemere, Surrey.*	1901
Gill, Sir David	*Royal Observatory, Cape Town.*	1898
Groth, Paul von	*Universität, Munich.*	1905
Hilbert, David	*Universität, Göttingen.*	(?)
Hoff, J. H. van't	*Universität, Berlin.*	(?)
Hooker, Sir J. D.	*The Camp, near Sunningdale.*	(?)
Huggins, Sir William	*90 Upper Tulse Hill, London.*	1904
Kapteyn, John C.	*Rijks Universiteit, Groningen.*	(?)
Klein, Felix	*Universität, Göttingen.*	1898
Koch, Robert	*Universität, Berlin.*	1903
Kohlrausch, Friedrich	*Universität, Berlin (resides Marburg).*	1901
Kronecker, Hugo	*Kantonale Universität, Berne.*	1901
Lankester, E. Ray	*South Kensington, London.*	1903
Larmor, Joseph	*St. Johns College, Cambridge.*	1908
Lister, Lord	*Regents Park, W., London.*	1898
Lorentz, Hendrik Anton	*Rijks Universiteit, Leiden.*	(?)
Ostwald, Wilhelm	*Grossbothen, bei Leipzig.*	(?)
Pavlov, Ivan P.	*Kais Inst. für Exper. Med., St. Petersburg.*	1908
Pfeffer, Wilhelm	*Bot. Inst. der Universität, Leipzig.*	1903
Picard, Emile	*Université, Paris.*	1903
Poincaré, Henri	*Université, Paris.*	1898
Ramsay, Sir William	*University College, London.*	1904
Rayleigh, Lord	*University, Cambridge.*	1898
Rosenbusch, H.	*Universität, Heidelberg.*	1904
Seeliger, Hugo Ritter von	*Universität, Munich.*	1908
Strasburger, Edouard	*Universität, Bonn.*	(?)
Suess, Edouard	*Universität, Vienna.*	1898
Thomson, Joseph John	*University, Cambridge.*	1903
Vries, Hugo de	*Universiteit, Amsterdam.*	1904
Zirkel, Ferdinand	*Universität, Leipzig.*	1903

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Louis	(†)	Dec. 14, 1873
Alexander, J. H.	(†)	Mar. 2, 1867
Alexander, Stephen	(†)	June 25, 1883
Bache, Alexander Dallas	(†)	Feb. 14, 1867
Baird, Spencer F.	1864	Aug. 19, 1887
Barnard, F. A. P.*	(†)	Apr. 27, 1889
Barnard, J. G.	(†)	May 14, 1882
Bartlett, W. H. C.*	(†)	Feb. 11, 1893
Beecher, Charles Emerson	1899	Feb. 14, 1904
Brooks, William Keith*	1884	Nov. 12, 1908
Brown-Sequard, Charles E.	1868	Apr. 2, 1894
Casey, Thomas L.	1890	Mar. 25, 1896
Caswell, Alexis	(†)	Jan. 8, 1887
Chauvenet, William	(†)	Dec. 13, 1870
Clarke, Henry James	1872	July 1, 1873
Coffin, James	1869	Jan. 6, 1873
Coffin, J. H. C.*	(†)	Jan. 8, 1890
Cook, George H	1887	Sept. 22, 1889
Cooke, Josiah P.	1872	Sept. 3, 1894
Cope, Edward D.	1872	Apr. 12, 1897
Coues, Elliott*	1877	Dec. 25, 1899
Dalton, J. C.	1864	Feb. 2, 1889
Dana, James D.*	(†)	Apr. 14, 1895
Davis, Charles H.	(†)	Feb. 14, 1877
Draper, Henry	1877	Nov. 20, 1882
Draper, John W.	1877	Jan. 4, 1882
Eads, James B.	1872	Mar. 8, 1887
Engelmann, George	(†)	Feb. 4, 1884
Ferrel, William	1868	Sept. 18, 1891
Frazer, John Fries	(†)	Oct. 12, 1872
Gabb, William M.	1876	May 30, 1878
Genth, F. A.	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gibbs, Wolcott*	(†)	Dec. 9, 1908
Gilliss, James Melville	(†)	Feb. 9, 1865
Goode, G. Brown	1888	Sept. 6, 1896
Gould, Augustus A.	(†)	Sept. 15, 1866
Gould, Benjamin A.*	(†)	Nov. 27, 1896
Gray, Asa	(†)	Jan. 30, 1888
Guyot, Arnold	(†)	Feb. 8, 1884
Hadley, James	1864	Aug. 1, 1872
Haldeman, S. S.	1876	Sept. 20, 1880
Hall, Asaph	1875	Nov. 22, 1907
Hall, James*	(†)	Aug. 8, 1898
Hayden, F. V.	1873	Dec. 22, 1887
Henry, Joseph	(†)	May 13, 1878
Hilgard, Julius E.	(†)	May 8, 1891
Hill, Henry B.	1883	Apr. 6, 1903
Hitchcock, Edward	(†)	Feb. 27, 1864
Holbrook, J. E.	1868	Sept. 8, 1871
Hubbard, J. S.	(†)	Aug. 16, 1863
Humphreys, A. A.	(†)	Nov. 28, 1883
Hunt, T. Sterry*	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Keeler, J. E.	1900	Aug. 12, 1900

* Biographical notices have not been presented of those designated by an asterisk.

† Charter members, March 3, 1863.

	Date of election.	Date of death.
King, Clarence	1876	Dec. 24, 1901
Kirkland, Jared P.	1865	Dec. 10, 1877
Lane, J. Homer	1872	May 3, 1880
Langley, Samuel P.*	1876	Feb. 27, 1906
Le Conte, John	1878	Apr. 29, 1891
Le Conte, John L.	(†)	Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carey	1892	Mar. 15, 1897
Leidy, Joseph*	(†)	Apr. 30, 1891
Lesley, J. Peter*	(†)	June 3, 1903
Lesquereux, Leo	1864	Oct. 25, 1889
Longstreth, Miers F.*	(†)	Dec. 27, 1891
Loomis, Elias	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore	1872	Sept. 10, 1897
Mahan, D. H.	(†)	Sept. 16, 1871
Marsh, G. P.	1866	July 23, 1882
Marsh, O. C.*	1874	Mar. 18, 1899
Mayer, Alfred M.*	1872	July 13, 1897
Mayo-Smith, Richmond*	1890	Nov. 11, 1901
Meek, F. B.	1869	Dec. 21, 1877
Meigs, M. C.	1865	Jan. 2, 1892
Mitchell, Henry*	1885	Dec. 1, 1902
Morgan, Lewis H.	1875	Dec. 14, 1881
Morton, Henry*	1874	May 9, 1902
Newberry, J. S.	(†)	Dec. 7, 1892
Newton, H. A.	(†)	Aug. 1, 1896
Newton, John	1876	May 1, 1895
Norton, William A.	1873	Sept. 21, 1883
Oliver, James E.	1872	Mar. 27, 1895
Packard, A. S.*	1872	Feb. 14, 1905
Penfield, Samuel L.	1900	Aug. 13, 1906
Peters, C. H. F.*	1876	July 18, 1890
Pourtales, L. F.	1873	July 19, 1880
Powell, John W.*	1880	Sept. 23, 1902
Rodgers, John	(†)	May 5, 1882
Rogers, Fairman	(†)	Aug. 23, 1900
Rogers, Robert E.	(†)	Sept. 7, 1884
Rogers, Wm. A.	1885	Mar. 1, 1898
Rogers, William B.	(†)	May 30, 1882
Rood, Ogden N.*	1885	Nov. 12, 1902
Rowland, Henry A.	1881	Apr. 16, 1901
Rutherford, Lewis M.	(†)	May 30, 1892
Saxton, Joseph	(†)	Oct. 26, 1873
Schott, Charles A.*	1872	July 31, 1901
Sellers, William*	1873	Jan. 24, 1905
Silliman, Benj., Sr.	(†)	Nov. 24, 1864
Silliman, Benj., Jr.*	(†)	Jan. 14, 1885
Smith, J. Lawrence	1872	Oct. 12, 1883
Stimpson, William*	1868	May 26, 1873
Strong, Theodore	(†)	Feb. 1, 1869
Sullivant, W. S.	1873	Apr. 30, 1882
Torrey, John	(†)	Mar. 10, 1873
Totten, J. G.	(†)	Apr. 22, 1864
Trowbridge, William P.	1872	Aug. 12, 1892

* Biographical notices have not been presented of those designated by an asterisk.

† Charter members, March 3, 1863.

Deceased members—Continued.

	Date of election.	Date of death.
TRUMBULL, JAMES H.*	1872	Aug. 5, 1897
TUCKERMAN, EDWARD	1868	Mar. 15, 1886
WALKER, FRANCIS A.	1878	Jan. 5, 1897
WARREN, G. K.	1876	Aug. 8, 1882
WATSON, JAMES C.	1868	Nov. 23, 1880
WATSON, SERENO	1889	Mar. 9, 1892
WINLOCK, JOSEPH	(†)	June 11, 1875
WOODWARD, J. J.	1873	Aug. 17, 1884
WORTHEN, A. H	1872	May 6, 1888
WYMAN, JEFFRIES	(†)	Sept. 4, 1874
YOUNG, CHARLES A.*	1872	Jan. 3, 1908

* Biographical notices have not been presented of those designated by an asterisk.

† Charter members, March 3. 1863.

DECEASED FOREIGN ASSOCIATES.

ADAMS, J. C.
AIRY, SIR GEORGE B.
ARGELANDER, F. W. A.
BAER, KARL ERNEST VON.
BARRANDE, JOACHIM.
BEAUMONT, L. ELIE DE.
BECQUEREL, HENRI.
BERTHELOT, M. P. E.
BERTRAND, J. L. F.
BOLTZMANN, LUDWIG.
BOUSSINGAULT, J. B. J. D.
BRAUN, ALEXANDER.
BREWSTER, SIR DAVID.
BUNSEN, ROBERT W.
BURMEISTER, C. H. C.
CANDOLLE, ALPHONSE DE.
CAYLEY, ARTHUR.
CHASLES, MICHEL.
CHEVREUL, M. E.
CLAUSIUS, RUDOLPH.
CORNU, ALFRED.
DOVE, H. W.
DUMAS, J. B.
FARRADAY, MICHAEL.
GEGENBAUR, KARL.
GYLDÉN, HUGO.
HAMILTON, SIR WILLIAM ROWAN.
HELMHOLTZ, BARON H. VON.
HOFMANN, A. W.
HUXLEY, T. H.
IBAÑEZ, CARLOS.
JANSSEN, J.
JOULE, JAMES P.
KEKULÉ, AUGUST.
KELVIN, LORD.
KIRCHOFF, G. R.
KÖLLIKER, ALBERT VON.
LACAZE-DUTHIERS, HENRI DE.
LEUCKART, RUDOLPH.
LIE, SOPHUS.
LIEBIG, JUSTUS VON.
LOEWY, MAURICE.
LUDWIG, K. F. W.
MAREY, E. J.
MENDELÉEFF, D. I.
MILNE-EDWARDS, HENRY.
MOISSAN, HENRI.
MURCHISON, SIR RODERICK I.
OPPOLZER, THEODORE VON.
OWEN, SIR RICHARD.
PASTEUR, LOUIS.
PETERS, C. A. F.
PLANA, G. A. A.
RAMMELSBERG, C. F.
REGNAULT, VICTOR.
REYMOND, EMIL DU BOIS.
RICHTHOFEN, F. VON.
SACHS, JULIUS VON.
STAS, JEAN SERVAIS.
STOKES, SIR GEORGE G.
STRUVE, OTTO VON.
SYLVESTER, J. J.
TISSERAND, F. F.
VIRCHOW, RUDOLPH VON.
VOGEL, H. C.
WEIERSTRASS, KARL.
WÖHLER, FRIEDRICH.
WÜRTZ, ADOLPH.
ZITTEL, K. A. R. VON.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1909

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

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LETTER OF TRANSMITTAL.

NATIONAL ACADEMY OF SCIENCES,
OFFICE OF THE PRESIDENT,
Washington, D. C., January 17, 1910.

SIR: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the year ending December 31, 1909.

Very respectfully,

IRA REMSEN, *President.*

The PRESIDENT OF THE SENATE.

ACT OF INCORPORATION.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted,* That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AMENDMENT.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said academy as provided in said act.

Approved, July 14, 1870.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

ANNUAL REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

SESSIONS OF THE NATIONAL ACADEMY.

During the year 1909 the academy held three sessions. The first was the regular annual session held at Washington, April 20 to 22, inclusive; the second, a scientific session held at Princeton, November 16 to 18, inclusive; and the third, a special session held at Princeton, November 16 and 17 for the transaction of business.

ANNUAL MEETING.

BUSINESS SESSION.

The business meetings were held at the Smithsonian Institution, Washington, D. C., April 20 to 22, 1909.

The following members were present during the session: Messrs. Abbot, Agassiz, Allen, Barker, Becker, Billings, Boas, Brewer, Brush, Cattell, Chandler (C. F.), Chittenden, Clark, Comstock (G. C.), Conklin, Cross, Dall, Davis, Elkin, Emmons, Gill, Hague, Hillebrand, Holmes, Iddings, Merriam, Mitchell, Morley, Morse (E. S.), Nichols (E. L.), Osborn, Pupin, Remsen, Scott, Walcott, Webster, Welch, White, Wilson, and Woodward.

REPORT OF THE HOME SECRETARY

The President of the National Academy of Sciences.

Sir: I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 20, 1909.

The annual report of the president of the academy for the year 1908 was transmitted to the United States Senate February 10, 1909, through the courtesy of Senator George P. Wetmore. The usual edition of 2,000 copies authorized by Congress was printed; 500 copies for the Senate, 1,000 copies for the House, and 500 copies for distribution by the Academy of Sciences. The report was received from the Government Printing Office April 15. Nearly one-half of the edition has been distributed to members of the academy, foreign associates, and such libraries and institutions as are on our domestic exchange list.

Messrs. S. A. Arrhenius, of Stockholm, Sweden; Charles Barrois, of Lille, France; Joseph Larmor, of Cambridge, England; Ivan Petrovic Pavlov, of St. Petersburg, Russia; and Hugo Ritter von Seeliger, of Munich, Germany, were elected foreign associates of the academy at the annual meeting in April, 1908.

Messrs. William B. Clark, Edwin G. Conklin, Whitman Cross, Simon Flexner, Edwin B. Frost, William F. Hillebrand, Ernest F. Nichols, Theobald Smith, and William E. Story, were elected members of the academy at the annual meeting in April, 1908.

The following biographical memoirs have been published during the year: Asaph Hall, by G. W. Hill; Alpheus Hyatt, by W. K. Brooks; Joseph Lovering, by B. Osgood Peirce; William More Gabb, by William H. Dall; Alexis Caswell, by Joseph Lovering (a reprint).

Two members have died during the past year: William K. Brooks, on November 12, and Wolcott Gibbs, on December 9, 1908. Henri Becquerel, an honored foreign associate, died August 25, 1908. There are now 105 active members on the membership list, 1 honorary member, and 42 foreign associates.

ARNOLD HAGUE, *Home Secretary*.

APRIL 20, 1909.

REPORT OF THE TREASURER.

The PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to transmit herewith my report as treasurer of the National Academy of Sciences for the year ending April 20, 1909:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.	Gould fund.	Emmons and Gill trustees.	Building fund.	Common stock fund.
Balance brought forward:									
Cash	$585.54	$2,827.45	....	$150.55	$534.45	$749.38	$147.86	$397.80	$198.68
Invested income	5,000.00	5,446.64	....	260.12	830.07	1,500.00	....	....	....
Receipts.									
Interest on investments	622.39	2,716.77	$1,147.45	501.89	479.82	1,009.50	450.00	64.19	420.00
Members' tax	535.00	....	....	....	....	....	....	....	....
Reimbursed	100.00	....	....	....	....	....	....	....	....
Total	6,842.93	10,990.86	1,147.45	912.56	1,844.34	3,258.88	597.86	461.99	618.68
Disbursements	870.56	5,383.31	492.75	14.40	14.40	45.47	103.16	16.06	14.40
Balance:									
Cash	972.37	[a]160.91	650.70	638.04	999.87	1,713.41	494.70	145.93	604.28
Invested income	5,000.00	5,446.64	4.00	260.12	830.07	1,500.00	....	300.00	....
Total	6,842.93	10,990.86	1,147.45	912.56	1,844.34	3,258.88	597.86	461.99	618.68

[a] Outstanding liabilities: H. C. Jones, $400.

S. F. EMMONS, *Treasurer*.

APRIL 20, 1909.

The treasurer's report was referred to an auditing committee composed of Messrs. Gill and Dall, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer; also that they have examined the securities and papers contained in the box of the academy at the American Security and Trust Company's building and have found them to correspond to the list furnished by the treasurer.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND.

(April 17, 1909.)

Since the last stated meeting of the academy, in April, 1908, the directors have made the following appropriations:

1908.		
May 11.	Gilbert N. Lewis For determination of free energy of formation of the important compounds of the alkali metals.	$300
May 11.	Joseph F. Ames For recalculation of standard wave lengths in accordance with request of International Congress for Solar Research.	1,000
May 11.	Henry Fairfield Osborn For Academy Committee on Correlation, for the paleontologic correlation of the American geologic horizons and formations with the European stages.	500
May 11.	Harry C. Jones For the determination of temperature coefficients of conductivity and of dissociation of electrolytes in aqueous solutions.	400
May 21.	C. H. Eigemann For Monograph of the American characins based on the material collected by Agassiz in the Thayer expedition, and by others since that time.	250
May 21.	Louis T. More For continuation of work on fatigue of metals, and experiments on the velocity of ions.	500
May 27.	B. Osgood Peirce For investigation of the magnetic behavior of large masses of iron and steel as regards the existence of a real time-lag in the magnetization.	500
May 27.	G. W. Pierce To determine the electrical and thermal properties of various crystalline substances, and experiments on radiation phenomena and electrical resonance.	500
1909.		
Feb. 4.	Norton Adams Kent To study structure of the lines of the arc spectra of metals, and to search for the same in the lines of spark spectra.	170
Feb. 4.	Richard E. Scammon For a series of graphic reconstructions of embryonic stages of the dogfish.	250
Feb. 7.	Harry C. Jones To continue the investigation on temperature coefficients of conductivity and of dissociation of electrolytes, begun under the above appropriation of May 11, 1908, to the same grantee.	400
Feb. 7.	Solomon F. Acree For the study of tautomerism and catalysis by electro-chemical methods.	400

Respectfully submitted.

Seth C. Chandler.
Ira Remsen.
C. S. Minot.

REPORT OF THE WATSON FUND.

Mr. Elkin, of the board of trustees of the Watson fund, reported that Prof. A. O. Leuschner, who has been working upon the Watson asteroids, was in Europe, and that the memoir was nearly ready for publication.

REPORT OF THE J. LAWRENCE SMITH FUND.

The committee on the J. Lawrence Smith fund for the investigation of meteoric bodies has to report that Doctor Farrington's catalogue of North American meteorites has been completed, and is in the hands of the secretary of the academy for publication.

No application for aid from the fund has been made during the past year.

Respectfully submitted.

Edward W. Morley, *Chairman*.

COMMITTEE ON THE BARNARD MEDAL.

The academy approved a motion made by the chairman of the committee on the Barnard medal that that committee be discharged and a new committee appointed.

The president announced the appointment of the following members on the committee: R. S. Woodward, chairman; W. W. Campbell, A. A. Noyes, E. F. Nichols, and T. W. Richards.

REPORT OF THE GIBBS FUND.

The committee on the Wolcott Gibbs fund for chemical research has the honor to report that the fund is at present accumulating, so that none of the income is available for grants.

C. L. Jackson, *Chairman*.

The treasurer stated that there would be an available income by the time of the next annual meeting.

REPORT OF THE COMSTOCK FUND.

Mr. Nichols, chairman of the committee, reported that, in accordance with the terms of the following paragraph from the deed of gift, the income of the fund would not be available for five years, and that, under the circumstances, the committee had nothing to report:

> The balance of the income of said fund shall be set aside and accumulated, and out of such accumulations the trustee shall award once for every five years a prize in money to the bona fide resident of North America who, not less than one year nor more than six years before the awarding of the prize, shall have made, in the judgment of the trustee, the most important discovery or investigation in electricity or magnetism or radiant energy.

COMMITTEE ON INTERNATIONAL COOPERATION IN RESEARCH.

The committee on cooperation in research met in Boston on April 5. Reports of progress were received from the committees on solar research, on chemical research, on paleontologic correlation, and on brain research.

The International Union for Cooperation in Solar Research has held three meetings, a preliminary one at St. Louis, and largely attended meetings at Oxford and Paris. The second volume of transactions has recently been published. Arrangements are now being made for the next meeting, which is to be held at Pasadena and Mount Wilson in 1910. A large amount of cooperative work is in progress under the auspices of the union.

The committee on chemical research has prepared a circular letter to investigators, inviting their cooperation, and the work will be developed rapidly as soon as Doctor Noyes is relieved from his present duties as acting president of the Institute of Technology (in a few weeks).

The committee recognized the importance of cooperative investigations in this country, as well as those of international scope, and decided to encourage promising opportunities in either field.

The chairman was authorized to invite several other members of the academy (selected by the committee) to join the committee, namely: Messrs. Mall, Moore, Chittenden, Chamberlin, Davis, and Wilson.

The importance of providing for *adequate means of publication of short papers*, as well as complete volumes of transactions, was recognized by the committee, and it was decided to request you to bring this matter to the attention of the council.

It was announced that the academy would be represented by one of the members of the committee (George E. Hale) at the council meeting of the International Association of Academies, to be held in Rome June 1-3 next. The appointment of Professor Hale was made by President Remsen.

Simon Newcomb.
A. A. Noyes.
C. S. Minot.
H. F. Osborn.
George E. Hale, *Chairman*.

Communicated by
Henry F. Osborn.

COMMITTEE ON INTERNATIONAL PALEONTOLOGIC CORRELATION.

Mr. Osborn, chairman of the vertebrate section of the committee on international paleontologic correlation, presented a report showing the plan and scope of the work which that section of the committee was doing. This report was published in the annals of the New York Academy of Sciences, Vol. XIX, No. 2, Par. I, pp. 41–44, under date of April 20, 1909: "Geologic Correlation Through Vertebrate Paleontology by International Cooperation, Correlation Bulletin No. 1: Plan and Scope."

GEORGE WASHINGTON MEMORIAL ASSOCIATION.

The academy adopted a resolution giving its approval of the general plan of the George Washington Memorial Association to collect funds for the purpose of erecting a building in the city of Washington adapted for a meeting place of scientific and other organizations.

APPOINTMENT OF DELEGATES.

The president announced the receipt of an invitation from the University of Leipzig for the National Academy of Sciences to send a representative on the occasion of the celebration of the five hundredth anniversary of the founding of the university, and stated that he had appointed Mr. Emmons to represent the academy on that occasion.

The home secretary read a letter from the president of the Reale Accademia dei Lincei, P. Blaserna, announcing a meeting of the council of the International Association of Academies at Rome, June 1–3, inclusive, and the president announced that Mr. George E. Hale had been appointed as delegate.

The president stated that the academy had been invited to send a delegate to the Darwin celebration to be held in Cambridge in June, and that he had appointed Mr. George E. Hale to represent the academy on that occasion.

COMMITTEE ON ELECTION OF FOREIGN ASSOCIATES.

On the recommendation of the council the academy adopted the following resolution:

Resolved, That, in view of the fact that the constitution provides for the nomination and election of foreign associates, the members of the committee on the election of foreign associates be discharged and the committee abolished.

ELECTION OF OFFICERS.

Mr. Alexander Agassiz was elected to succeed Mr. Simon Newcomb as foreign secretary of the academy for a term of six years.

Messrs. Woodward and Davis were elected to serve as members of the council of the academy for three years.

ELECTION OF NEW MEMBERS.

Messrs. Joseph S. Ames, Maxime Bôcher, Oskar Bolza, F. W. Clarke, J. M. Clarke, J. M. Coulter, Henry Crew, Waldemar Lindgren, Thomas H. Morgan, and Henry L. Wheeler were elected members of the academy.

ELECTION OF FOREIGN ASSOCIATES.

The following were elected foreign associates of the academy: Albrecht Penck, of Berlin, Germany; Gustav Retzius, of Stockholm, Sweden; Wilhelm Waldeyer, of Berlin, Germany; and Wilhelm Wundt, of Leipzig, Germany.

SCIENTIFIC SESSION.

The scientific meetings were held in the National Museum, Washington, D. C., April 20–22, 1909. The following papers were presented:

The Nature and Possible Origin of the Milky Way. G. C. Comstock.
Determinations of Stellar Parallax from Photographs made by Arthur R. Hincks and the writer., H. N. Russell. (Introduced by G. C. Comstock.)
Strange Ceremonial Costumes of California Indians. C. Hart Merriam.
Archaeological Problems of the Titicacan Plateau. W. H. Holmes.
Discovery of a Complete Skeleton of Tyrranosaurus in the Upper Cretaceous. H. F. Osborn.
An Iguanodont Dinosaur (Trachodon) with the Epidermis Preserved. H. F. Osborn.
Stratigraphic Relations and Paleontology of the Lower Member of the Fort Union Formation. F. H. Knowlton. (Introduced by Whitman Cross.)
The Deep-Sea Bottom of the Eastern Tropical Pacific, from Observations on the Albatross Expedition. Sir John Murray. (Communicated by A. Agassiz.)
The Medusae of the Eastern Tropical Pacific, from Observations on the Albatross Expedition. H. B. Bigelow. (Communicated by A. Agassiz.)
Mythology of the Mewan Indians of California. C. Hart Merriam.
The Radiation from Gases Heated by Sudden Compression. E. F. Nichols and G. P. Pegram.
Biographical Memoir of Elliott Coues. J. A. Allen.
Biographical Memoir of Ogden N. Rood. E. L. Nichols.
The Electrolytic Separation of the Chlorides of Barium and Radium. Edgar F. Smith.
The Orders of Teleostomous Fishes (Pisces). Theo. Gill.
Biographical Memoir of Charles A. Schott. Cleveland Abbe.
The Distribution of the Recent Crinoids. Austin H. Clark. (Introduced by Theo. Gill.)
On the Distribution of Energy in the Spectrum of the Light from Fluorescent Substances. E. L. Nichols and Ernest Merritt.
A Geographical Excursion in Northern Italy. W. M. Davis.

AUTUMN MEETING.

SCIENTIFIC SESSION.

A scientific session called by the council for the reading of papers was held at Princeton University, Princeton, N. J., November 16–18, 1909.

The following members were present during the session: Messrs. Abbe, Barus, Becker, Boss, Cattell, Chandler (C. F.), Clark (W. B.), Clarke (F. W.), Clarke (J. M.), Conklin, Councilman, Dana, Davis, Emmons, Flexner, Frost, Hague, Hastings, Hillebrand, Lindgren, Mitchell, Morgan, Morley, Morse (E. S.), Noyes, Osborn, Putnam, Remsen, Scott, Smith, Thomson, Walcott, Webster, Welch, Wells, Wilson, and Woodward.

The following papers were presented:

On the Presence of Teeth in Echinoneus Van Phels. A. Agassiz.
The Geology of South Africa. W. B. Scott.
Formative Substances in Eggs. E. G. Conklin.

A Study of Immunity to Self-fertilization in Ciona. T. H. Morgan.
Meteor Crater, Arizona. D. M. Barringer. (Introduced by W. B. Scott.)
Derivatives of Tantalum. E. F. Smith.
Some New Methods in Electro-analysis. E. F. Smith.
The Emission of Electricity by Hot Bodies. O. W. Richardson. (Introduced by W. B. Scott.)
The Physiography of Southeastern Alaska. W. M. Davis.
The Yale Expedition of 1909 to Palestine and Syria. E. Huntington. (Introduced by W. M. Davis.)
The Early Stages of Acmæa. E. S. Morse.
The Transmission of Epidemic Poliomyelitis to Monkeys. S. Flexner.
The Present Status of the Ether. A. G. Webster.
Examples of Recent Photographs made at the Yerkes Observatory. E. B. Frost.
Preliminary notice of a paper on The Development of Olenellus. C. D. Walcott.
Report of Investigations on the Correlation of Tertiary and Quaternary Horizons in Europe and North America. H. F. Osborn.
The Skull of Tyrannosaurus. H. F. Osborn.
The Fission of Double Stars. H. N. Russel. (Introduced by W. B. Scott.)
The First Movements of the Vertebrate Embryo in Relation to the Development of the Nervous System. S. Paton. (Introduced by E. G. Conklin.)
The Development of Electric Tissue in Teleost fishes. U. Dahlgren. (Introduced by E. G. Conklin.)
The Relative Sizes of Cells and Nuclei. E. G. Conklin.
Memoir of Wolcott Gibbs. F. W. Clarke.
Memoir of W. K. Brooks. E. G. Conklin.
Biographical Sketch of C. A. Young. E. B. Frost.

BUSINESS SESSION.

The business meetings were held at Princeton University, Princeton, N. J., November 16 and 17, 1909.

MEDAL.

The academy adopted the following resolution:

Resolved, That favorable action be taken on Mr. Becker's proposal that a medal be conferred by the academy for eminence in the application of science to the public welfare, and that Mr. Becker's offer to give a die for such a medal be accepted, all details to be subject to the approval of the council.

Further, that a committee of the academy be appointed by the president to secure, if possible, a fund for the preparation of an artistic die from which later medals shall be struck.

The president appointed the following committee:

Mr. A. G. Webster, chairman; and Messrs. Becker, Holmes, Morley, and Osborn.

J. LAWRENCE SMITH FUND.

On the recommendation of the committee on the J. Lawrence Smith fund, the academy voted to make the following grants:

1. Four hundred dollars to Dr. E. O. Hovey, to aid in the study of some recent meteoric irons.
2. Four hundred dollars to Prof. T. C. Trowbridge, to aid in studies of the nature of the luminous trains of meteors.

APPOINTMENTS.

The president announced the following changes in the personnel of the committees of the academy:

G. C. Comstock to be chairman of the committee on mathematics and astronomy, in place of the late Professor Newcomb.

A. G. Webster to the committee on weights, measures, and coinage, in place of the late Professor Newcomb.

Lewis Boss to be chairman of the committee on the Watson fund, in place of the late Professor Newcomb.

E. B. Frost to the committee on the Watson fund.

George E. Hale to be chairman of the committee on the Henry Draper fund, in place of the late Professor Newcomb.

W. W. Campbell to the committee on the Henry Draper fund.

Arnold Hague to the committee on the J. Lawrence Smith fund, in place of the late Professor Johnson.

COMMITTEE ON INTERNATIONAL PALEONTOLOGIC CORRELATION.

Mr. Osborn, chairman of the vertebrate section of the committee on international paleontologic correlation, presented a report showing the progress which the committee had made to date.

DEATHS DURING 1909.

Simon Newcomb died on the 11th of July, and S. W. Johnson died on the 21st of July, 1909.

SIMON NEWCOMB.

Simon Newcomb was born at Wallace, Nova Scotia, March 12, 1835. He was of New England ancestry through six generations of men, who, with the exception of his father, bore the name of Simon Newcomb. His early education was acquired under the care of his father, who followed during most of his life the occupation of a country school-teacher in Nova Scotia, in Prince Edward Island, and later in the United States. Four years after coming to the United States, in 1853, Professor Newcomb secured a position as a computer in the American Ephemeris and Nautical Almanac Office, then located at Cambridge, Mass. While engaged in this work, he pursued academic studies at the Lawrence Scientific School of Harvard University, and attained the degree of B. S. in 1858. In 1861 he was appointed professor of mathematics in the United States Navy and assigned to duty at the United States Naval Observatory, at Washington. He was placed in charge of the American Ephemeris and Nautical Almanac Office in 1877, and retained this position until he reached the age limit for retirement, in 1897. In 1903 he became a research associate of the Carnegie Institution of Washington, and he continued his researches in this capacity up to the time of his death, July 11, 1909.

Early in life Professor Newcomb set for himself the gigantic task of bringing the observed motions of the members of the solar system into harmony with the Newtonian law of attraction, and for nearly fifty years he devoted himself chiefly to this arduous branch of dynamical astronomy. His contributions to the theories of the motions of the moon and the planets are among the most important made since the publication of the Mécanique Céleste of Laplace. This great principal work led him also to make important contributions to all other branches of astronomy and to many branches of pure and applied mathematics.

Professor Newcomb became a member of the National Academy of Sciences in 1869. Academic institutions and learned societies of the entire civilized world bestowed numerous honors upon him. He was elected a correspondent of the Institute of France in 1874 and a foreign associate in 1893. He was one of the most fertile and productive of investigators in the history of American science.

SAMUEL W. JOHNSON.

Samuel W. Johnson was born July 3, 1830, and was elected a member of the academy in 1866. From his tenth to his seventeenth year he studied at Lowville Academy, where he obtained his first knowledge of chemistry under Prof. David Porter Mayhew, whose assistant he became. While there, in 1847, he published his paper "On Fixing Ammonia." He entered Yale in 1850 and studied under Norton and Silliman. In 1853 he went to Europe and worked in the laboratories of Erdmann, Liebig, Kobel, and Pettenkofer. He also attended some of the lectures of Chevreul in Paris. In 1856 he was made professor of analytical chemistry in the Sheffield Scientific School, and in 1857 succeeded Porter in the chair of agricultural chemistry, which he occupied until 1875. He was then appointed professor of agricultural and theoretical chemistry, and he continued to teach these subjects as well as organic chemistry until his retirement in 1895. He died July 21, 1909.

His books, "How Crops Grow" and "How Crops Feed," have been translated into many foreign languages, and are the most widely read books of their kind in the world.

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907; November 20, 1907.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

SEC. 3. The academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the academy shall be a president, a vice-president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the academy until the next stated session of the academy.

SEC. 2. The officers of the academy, together with six members to be elected by the academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the academy.

SEC. 3. The president of the academy, or, in case of his absence or inability to act, the vice-president, shall preside at the meetings of the academy and of the council: shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its sessions next ensuing: and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the first stated session in each year.

SEC. 4. Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the subject in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

SEC. 5. The academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Election to membership shall be held as described below. There shall be two ballots—a preference ballot, which may be prepared either before or at the meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

1. *Preference ballot.*—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on

this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

2. *Final ballot.*—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 20 votes in all, provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

Election of members shall be held at the regular stated session of each year held in Washington, and not more than 10 members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

Sec. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

Sec. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council and may be elected at the regular stated session of each year, held in Washington, by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.

Recommendations for nomination of foreign associates may be sent to the home secretary at any time.

Sec. 8. A diploma, with the corporate seal of the academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

Sec. 9. Resignations shall be addressed to the president and acted on by the academy.

Sec. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the academy with the recommendation that

the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated session.

SEC. 5. The advice of the academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the academy, in stocks of the United States, or, with the approval of the council, in state bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the academy.

SEC. 2. No contract shall be binding upon the academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the academy shall be fixed by the academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee to be appointed by the president at or before the annual meeting. This committee shall also inspect and verify the bonds, securities, and other property in the custody of the treasurer. The report of this committee shall be presented to the academy before the close of the session.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice-president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the academy.

X. Memoirs shall date, in the records of the academy, from the date of their presentation to the academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the academy as early as practicable, and not later than the next stated session.

XII. The annual report of the academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make

scientific investigations at the request of departments of the Government, and in each case to look to the department requesting the investigation for reimbursement to the academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XIX. All discussions as to the claims and qualifications of nominees at meetings of the academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the academy at the time of the discussion.

XX. Any rule of the academy may be amended, suspended, or repealed on the written motion of any two members, signed by them, and presented at a stated session of the academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1908-9.

	Expiration of term.
Remsen, Ira, *President*	April, 1913
Walcott, C. D., *Vice-President*	April, 1913
Agassiz, Alexander, *Foreign Secretary*	April, 1915
Hague, Arnold, *Home Secretary*	April, 1913
Emmons, S. F., *Treasurer*	April, 1914

ADDITIONAL MEMBERS OF COUNCIL.

1907-1910.

Hale, George E.
Osborn, Henry F.

1908-1911.

Welch, W. H.
Wilson, E. B.

1909-1912.

Davis, W. M.
Woodward, R. S.

COMMITTEES OF THE ACADEMY.

ON NOMINATION OF NEW MEMBERS.

1. Mathematics and Astronomy.
    - Abbe, C.
    - Bôcher, Maxime.
    - Bolza, Oskar.
    - Boss, Lewis.
    - Campbell, W. W.
    - Chandler, S. C.
    - Comstock, G. C. (Chairman).
    - Davidson, G.
    - Elkin, W. L.
    - Frost, E. B.
    - Hale, G. E.
    - Hill, G. W.
    - Holden, E. S.
    - Moore, E. H.
    - Osgood, W. F.
    - Peirce, C. S.
    - Pickering, E. C.
    - Story, W. E.
    - Webster, A. G.
    - Woodward, R. S.
2. Physics and Engineering.
    - Abbe, C.
    - Abbot, H. L.
    - Ames, J. S.
    - Barker, G. F.
    - Barus, C.
    - Bell, A. G.
    - Comstock, C. B.
    - Crew, Henry.
    - Hastings, C. S.
    - Mendenhall, T. C.
    - Michelson, A. A.
    - Morley, E. W.
    - Nichols, E. F.
    - Nichols, E. L.
    - Peirce, B. O.
    - Pickering, E. C.
    - Pupin, M. I.
    - Thomson, Elihu.
    - Trowbridge, J.
    - Webster, A. G.

2. Physics and Engineering—Continued.
   - Woodward, R. S. (Chairman).
   - Wright, A. W.
3. Chemistry.
   - Barker, G. F.
   - Brush, G. J.
   - Chandler, C. F.
   - Chittenden, R. H.
   - Clarke, F. W.
   - Crafts, J. M.
   - Dana, E. S.
   - Gooch, F. A.
   - Hilgard, E. W.
   - Hillebrand, W. F.
   - Jackson, C. L.
   - Michael, A.
   - Morley, E. W.
   - Morse, H. N.
   - Nef, John U.
   - Noyes, A. A. (Chairman).
   - Remsen, Ira.
   - Richards, T. W.
   - Smith, E. F.
   - Wells, H. L.
   - Wheeler, H. L.
4. Geology and Paleontology.
   - Agassiz, A.
   - Becker, G. F.
   - Branner, J. C.
   - Chamberlin, T. C.
   - Clark, W. B.
   - Clarke, J. M.
   - Cross, Whitman.
   - Dall, W. H.
   - Davis, W. M.
   - Dutton, C. E.
   - Emmons, S. F.
   - Gilbert, G. K.
   - Hague, Arnold (Chairman).
   - Iddings, J. P.
   - Lindgren, Waldemar.
   - Osborn, H. F.
   - Pumpelly, R.
   - Scott, W. B.
   - Van Hise, C. R.
   - Walcott, C. D.
   - White, C. A.
5. Biology.
   - Agassiz, A.
   - Allen, J. A.
   - Bowditch, H. P.
   - Brewer, W. H.
   - Chittenden, R. H. (Chairman).
   - Conklin, E. G.
   - Coulter, J. M.
   - Councilman, W. T.
   - Dall, W. H.
   - Farlow, W. G.
   - Gill, T. N.
   - Goodale, G. L.
   - Howell, W. H.
   - Mall, F. P.
   - Mark, E. L.
   - Merriam, C. H.
   - Minot, C. S.
   - Morgan, T. H.
   - Morse, E. S.
   - Osborn, H. F.
   - Prudden, T. M.
   - Putnam, F. W.
   - Sargent, C. S.
   - Smith, Theobald.
   - Scudder, S. H.
   - Trelease, William.
   - Verrill, A. E.
   - Walcott, C. D.
   - Welch, W. H.
   - White, C. A.
   - Whitman, C. O.
   - Wilson, E. B.
   - Wood, H. C.
6. Anthropology.
   - Billings, J. S. (Chairman).
   - Boas, Franz.
   - Cattell, J. McK.
   - Flexner, Simon.
   - Holmes, W. H.
   - Merriam, C. H.
   - Minot, C. S.
   - Mitchell, S. W.
   - Morse, E. S.
   - Peirce, C. S.
   - Putnam, F. W.
   - Royce, Josiah.
   - Welch, W. H.

ON WEIGHTS, MEASURES, AND COINAGE.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Webster, A. G.
Morley, E. W.
Peirce, C. S.
Comstock, C. B.
Woodward, R. S.

ON PUBLICATION.

The President. The Home Secretary. Walcott, C. D.

ON SOLAR RESEARCH.

Hale, George E., *Chairman.* Michelson, A. A. Comstock, G. C.
Campbell, W. W. Nichols, E. L.

TRUST FUNDS.

BOARD OF DIRECTION OF THE BACHE FUND.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Chandler, S. C., *Chairman.* Remsen, Ira. Minot, C. S.

BOARD OF TRUSTEES OF THE WATSON FUND.

[1883, residual estate, $18,666.88.]

For the promotion of astronomical research.

Boss, Lewis, *Chairman.* Elkin, W. L. Frost, E. B.

THE HENRY DRAPER FUND.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Hale, George E., *Chairman.* Trowbridge, John. Wright, A. W.
Campbell, W. W. Michelson, A. A.

THE J. LAWRENCE SMITH FUND.

[1885, $8,000.]

For the investigation of meteoric bodies.

Morley, E. W., *Chairman.* Dana, E. S. Hague, Arnold.
Pumpelly, R. Remsen, Ira.

THE BENJAMIN APTHORP GOULD FUND.

[1897, $20,000.]

For researches in astronomy.

Boss, Lewis, *Chairman.* Chandler, S. C. Hill, G. W.

THE BARNARD MEDAL.[a]

For meritorious service to science.

Woodward, R. S., *Chairman*. Campbell, W. W. Noyes, A. A.
Nichols, E. F. Richards, T. W.

THE WOLCOTT GIBBS FUND.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman*. Remsen, Ira. Smith, Edgar F.

THE COMSTOCK TRUST FUND.

[1907, $10,000.]

For researches in electricity, magnetism, and radiant energy.

Nichols, E. L., *Chairman*. Noyes, Arthur A. Thomson, Elihu.
Hale, Geo. E. Webster, A. G.

THE MARSH TRUST FUND.

[1909, $1,250.]

For promoting original research in the natural sciences.

JOSEPH HENRY FUND.

To assist meritorious investigators, especially in the direction of original research.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

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[a] Every five years the committee recommends the person whom they consider most deserving of the medal, and upon the approval of the academy the name of the nominee is forwarded to the trustees of Columbia College, who administer the Barnard medal fund.

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, JANUARY 31, 1910.

		Date of election.
Abbe, Cleveland	*U. S. Weather Bureau, Washington, D. C.*	1879
Abbot, Henry L., U. S. A.	*23 Berkeley st., Cambridge, Mass.*	1872
Agassiz, Alexander	*Cambridge, Mass.*	1866
Allen, J. Asaph	*American Museum of Natural History, New York City.*	1876
Ames, Joseph S.	*Johns Hopkins University, Baltimore, Md.*	1909
Barker, George F.	*3909 Locust st., Philadelphia, Pa.*	1876
Barus, Carl	*Brown University, Providence, R. I.*	1892
Becker, George F.	*U. S. Geological Survey, Washington, D. C.*	1901
Bell, A. Graham	*1331 Connecticut ave., Washington, D. C.*	1883
Billings, John S., U. S. A.	*32 E. Thirty-first st., New York City.*	1883
Boas, Franz	*123 W. Eighty-second st., New York City.*	1900
Bôcher, Maxime	*Harvard University, Cambridge, Mass.*	1909
Bolza, Oskar	*University of Chicago, Chicago, Ill.*	1909
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Bowditch, Henry P.	*Harvard Medical School, Boston, Mass.*	1887
Branner, John C.	*Stanford University, California.*	1905
Brewer, William H.	*418 Orange st., New Haven, Conn.*	1880
Brush, George J.	*14 Trumbull st., New Haven, Conn.*	1868
Campbell, William W.	*Lick Observatory, Mt. Hamilton, California.*	1902
Cattell, James McK.	*Garrison, N. Y.*	1901
Chamberlin, Thomas C.	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F.	*Columbia University, New York City.*	1874
Chandler, Seth C.	*Box 216, Wellesley Hills, Mass.*	1888
Chittenden, Russell H.	*Sheffield Scientific School, New Haven, Conn.*	1890
Clark, W. B.	*Johns Hopkins University, Baltimore, Md.*	1908
Clarke, F. W.	*U. S. Geological Survey, Washington, D. C.*	1909
Clarke, J. M.	*State Hall, Albany, N. Y.*	1909
Comstock, Cyrus B., U. S. A.	*124 E. Twenty-seventh st., New York City.*	1884
Comstock, George C.	*Washburn Observatory, Madison, Wis.*	1899
Conklin, E. G.	*Princeton, N. J.*	1908
Coulter, J. M.	*University of Chicago, Chicago, Ill.*	1909
Councilman, Wm. T.	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M.	*59 Marlborough st., Boston, Mass.*	1872
Crew, Henry	*Northwestern University, Evanston, Ill.*	1909
Cross, Whitman	*U. S. Geological Survey, Washington, D. C.*	1908
Dall, William H.	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S.	*Yale University, New Haven, Conn.*	1884
Davidson, George	*2221 Washington st., San Francisco, Cal.*	1874
Davis, William Morris	*17 Francis ave., Cambridge, Mass.*	1904
Dutton, Clarence E., U. S. A.	*Englewood, N. J.*	1884
Elkin, William L.	*Yale University Observatory, New Haven, Conn.*	1895
Emmons, Samuel F.	*U. S. Geological Survey, Washington, D. C.*	1892
Farlow, W. G.	*Harvard University, Cambridge, Mass.*	1879
Flexner, Simon	*Rockefeller Institute, New York City.*	1908
Frost, Edwin B.	*Yerkes Observatory, Williams Bay, Wis.*	1908
Gilbert, Grove K.	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N.	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A.	*Yale University, New Haven, Conn.*	1897
Goodale, George L.	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885

		Date of election.
Hale, George E.	*Solar Observatory office, Pasadena, Cal.*	1902
Hastings, Charles S.	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W.	*University of California, Berkeley, Cal.*	1872
Hill, George W.	*West Nyack, N. Y.*	1874
Hillebrand, William F.	*Bureau of Standards, Washington, D. C.*	1908
Holden, Edward S.	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H.	*U. S. National Museum, Washington, D. C.*	1905
Howell, William H.	*Johns Hopkins University, Baltimore, Md.*	1905
Iddings, Joseph P.	*7 Sheffield Road, Winchester, Mass.*	1907
Jackson, Charles L.	*6 Boylston Hall, Cambridge, Mass.*	1883
Lindgren, Waldemar	*U. S. Geological Survey, Washington, D. C.*	1909
Mall, Franklin P.	*Anatom. Lab., Sta. O, Baltimore, Md.*	1907
Mark, Edward L.	*109 Irving st., Cambridge, Mass.*	1903
Mendenhall, Thomas C.	*Worcester, Mass.*	1887
Merriam, C. Hart	*Department of Agriculture, Washington, D. C.*	1902
Michael, Arthur	*Tufts College, Mass.*	1889
Michelson, Albert A.	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S.	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut st., Philadelphia, Pa.*	1865
Moore, Eliakim H.	*University of Chicago, Chicago, Ill.*	1901
Morgan, T. H.	*Columbia University, New York City.*	1909
Morley, Edward W.	*West Hartford, Conn.*	1897
Morse, Edward S.	*P. O. Box 268, Salem, Mass.*	1876
Morse, Harmon N.	*Johns Hopkins University, Baltimore, Md.*	1907
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Nichols, Edward L.	*Cornell University, Ithaca, N. Y.*	1901
Nichols, Ernest F.	*Dartmouth College, Hanover, N. H.*	1908
Noyes, Arthur A.	*Massachusetts Institute of Technology, Boston, Mass.*	1905
Osborn, H. F.	*American Museum of Natural History, New York City.*	1900
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Benjamin O.	*Harvard University, Cambridge, Mass.*	1906
Peirce, Charles S.	*Milford, Pa.*	1876
Pickering, Edward C.	*Harvard College Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs ave., Newport, R. I.*	1872
Pupin, Michael I.	*Columbia University, New York City.*	1905
Putnam, Frederick W.	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W.	*Harvard University, Cambridge, Mass.*	1899
Royce, Josiah	*Harvard University, Cambridge, Mass.*	1906
Sargent, Charles S.	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Scott, William B.	*Princeton University, Princeton, N. J.*	1906
Scudder, Samuel H.	*Cambridge, Mass.*	1877
Smith, Edgar F.	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Theobald	*Harvard Medical School, Boston, Mass.*	1908
Story, William E.	*Clark University, Worcester, Mass.*	1908
Thomson, Elihu	*Swampscott, Mass.*	1907
Trelease, Wm.	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R.	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E.	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D.	*Smithsonian Institution, Washington, D. C.*	1896

		Date of election.
Webster, Arthur G.	*Clark University, Worcester, Mass.*	1903
Welch, William H.	*807 St. Paul st., Baltimore, Md.*	1895
Wells, Horace L.	*Yale University, New Haven, Conn.*	1903
Wheeler, Henry L.	*Sheffield Scientific School, New Haven, Conn.*	1909
White, Charles A.	*1908 13th st., NW., Washington, D. C.*	1889
Whitman, Charles O.	*University of Chicago, Chicago, Ill.*	1895
Wilson, Edmund B.	*Columbia University, New York City.*	1899
Wood, Horatio C.	*4107 Chester ave., Philadelphia, Pa.*	1879
Woodward, Robert S.	*Carnegie Institution, Washington, D. C.*	1896
Wright, Arthur W.	*Yale University, New Haven, Conn.*	1881

HONORARY MEMBER.

Smith, Sidney I.	*Yale University, New Haven, Conn.*	1884

FOREIGN ASSOCIATES.

Arrhenius, S. A.	*Nobelinstitut, Stockholm.*	1908
Auwers, Arthur	*Königl. Akad. der Wissenschaften, Berlin.*	1883
Backlund, Oskar	*Astron. Sternwarte, Pulkowo.*	1903
Baeyer, Adolph Ritter von	*Universität, Munich.*	1898
Barrois, Charles	*Université, Lille.*	1908
Bornet, Edouard	*Paris.*	1901
Brögger, W. C.	*Universitet, Christiania.*	1903
Darwin, Sir George Howard	*Newnham Grange, Cambridge.*	1904
Dewar, Sir James	*University, Cambridge.*	1907
Ehrlich, Paul	*Königl. Inst. für Exper. Therapie, Frankfurt a. Main.*	1904
Fischer, Emil	*Chemisches Inst. der Universität, Berlin.*	1904
Forsyth, A. R.	*Trinity College, Cambridge.*	1907
Geikie, Sir Archibald	*Haslemere, Surrey.*	1901
Gill, Sir David	*Royal Observatory, Cape Town.*	1898
Groth, Paul von	*Universität, Munich.*	1905
Hilbert, David	*Universität, Göttingen.*	1907
Hoff, J. H. van't	*Universität, Berlin.*	(?)
Hooker, Sir J. D	*14 South Parade, Bath.*	(?)
Huggins, Sir William	*90 Upper Tulse Hill, London.*	1904
Kapteyn, John C.	*Rijks Universiteit, Groningen.*	1907
Klein, Felix	*Universität, Göttingen.*	1898
Koch, Robert	*Universität, Berlin.*	1903
Kronecker, Hugo	*Kantonale Universität, Berne.*	1901
Lankester, E. Ray	*South Kensington, London.*	1903
Larmor, Joseph	*St. Johns College, Cambridge.*	1908
Lister, Lord	*Regents Park, W., London.*	1898
Lorentz, Hendrik Anton	*Rijks Universiteit, Leiden.*	1906
Ostwald, Wilhelm	*Grossbothen, bei Leipzig.*	1906
Pavlov, Ivan P.	*Kais Inst. für Exper. Med., St. Petersburg.*	1908
Penck, Albrecht	*Universität, Berlin.*	1909
Pfeffer, Wilhelm	*Bot. Inst. der Universität, Leipzig.*	1903
Picard, Emile	*Université, Paris.*	1903
Poincaré, Henri	*Université, Paris.*	1898
Ramsay, Sir William	*University College, London.*	1904
Rayleigh, Lord	*University, Cambridge.*	1898
Retzius, Gustav	*Universitet, Stockholm.*	1909

		Date of election.
ROSENBUSCH, H.	*Universität, Heidelberg.*	1904
SEELIGER, HUGO RITTER VON	*Universität, Munich.*	1908
STRASBURGER, EDOUARD	*Universität, Bonn.*	(?)
SUESS, EDOUARD	*Universität, Vienna.*	1898
THOMSON, JOSEPH JOHN	*University, Cambridge.*	1903
VRIES, HUGO DE	*Universiteit, Amsterdam.*	1904
WALDEYER, WILHELM	*Universität, Berlin.*	1909
WUNDT, WILHELM	*Universität, Leipzig.*	1909
ZIRKEL, FERDINAND	*Königsstrasse 2a, Bonn.*	1903

DECEASED MEMBERS.

	Date of election.	Date of death.
AGASSIZ, LOUIS	(†)	Dec. 14, 1873
ALEXANDER, J. H.	(†)	Mar. 2, 1867
ALEXANDER, STEPHEN	(†)	June 25, 1883
BACHE, ALEXANDER DALLAS	(†)	Feb. 14, 1867
BAIRD, SPENCER F.	1864	Aug. 19, 1887
BARNARD, F. A. P.*	(†)	Apr. 27, 1889
BARNARD, J. G.	(†)	May 14, 1882
BARTLETT, W. H. C.*	(†)	Feb. 11, 1893
BEECHER, CHARLES EMERSON	1899	Feb. 14, 1904
BROOKS, WILLIAM KEITH	1884	Nov. 12, 1908
BROWN-SEQUARD, CHARLES E.	1868	Apr. 2, 1894
CASEY, THOMAS L.	1890	Mar. 25, 1896
CASWELL, ALEXIS	(†)	Jan. 8, 1887
CHAUVENET, WILLIAM	(†)	Dec. 13, 1870
CLARKE, HENRY JAMES	1872	July 1, 1873
COFFIN, JAMES	1869	Jan. 6, 1873
COFFIN, J. H. C.*	(†)	Jan. 8, 1890
COOK, GEORGE H.	1887	Sept. 22, 1889
COOKE, JOSIAH P.	1872	Sept. 3, 1894
COPE, EDWARD D.	1872	Apr. 12, 1897
COUES, ELLIOTT	1877	Dec. 25, 1899
DALTON, J. C.	1864	Feb. 2, 1889
DANA, JAMES D.*	(†)	Apr. 14, 1895
DAVIS, CHARLES H.	(†)	Feb. 14, 1877
DRAPER, HENRY	1877	Nov. 20, 1882
DRAPER, JOHN W.	1877	Jan. 4, 1882
EADS, JAMES B.	1872	Mar. 8, 1887
ENGELMANN, GEORGE	(†)	Feb. 4, 1884
FERREL, WILLIAM	1868	Sept. 18, 1891
FRAZER, JOHN FRIES	(†)	Oct. 12, 1872
GABB, WILLIAM M.	1876	May 30, 1878
GENTH, F. A.	1872	Feb. 2, 1893
GIBBS, JOSIAH WILLARD	1879	Apr. 28, 1903
GIBBS, WOLCOTT	(†)	Dec. 9, 1908
GILLISS, JAMES MELVILLE	(†)	Feb. 9, 1865
GOODE, G. BROWN	1888	Sept. 6, 1896
GOULD, AUGUSTUS A.	(†)	Sept. 15, 1866
GOULD, BENJAMIN A.*	(†)	Nov. 27, 1896
GRAY, ASA	(†)	Jan. 30, 1888
GUYOT, ARNOLD	(†)	Feb. 8, 1884

* Biographical notices have not been presented of those designated by an asterisk.

† Charter members, March 3, 1863.

	Date of election.	Date of death.
Hadley, James	1864	Aug. 1, 1872
Haldeman, S. S	1876	Sept. 20, 1880
Hall, Asaph	1875	Nov. 22, 1907
Hall, James*	(†)	Aug. 8, 1898
Hayden, F. V	1873	Dec. 22, 1887
Henry, Joseph	(†)	May 13, 1878
Hilgard, Julius E	(†)	May 8, 1891
Hill, Henry B	1883	Apr. 6, 1903
Hitchcock, Edward	(†)	Feb. 27, 1864
Holbeook, J. E	1868	Sept. 8, 1871
Hubbard, J. S	(†)	Aug. 16, 1863
Humphreys, A. A	(†)	Nov. 28, 1883
Hunt, T. Sterry*	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Johnson, S. W.*	1866	July 21, 1909
Keeler, J. E	1900	Aug. 12, 1900
King, Clarence	1876	Dec. 24, 1901
Kirkland, Jared P	1865	Dec. 10, 1877
Lane, J. Homer	1872	May 3, 1880
Lanoley, Samuel P.*	1876	Feb. 27, 1906
Le Conte, John	1878	Apr. 29, 1891
Le Conte, John L	(†)	Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carry	1892	Mar. 15, 1897
Leidy, Joseph*	(†)	Apr. 30, 1891
Lesley, J. Petee*	(†)	June 3, 1903
Lesquereux, Leo	1864	Oct. 25, 1889
Longstreth, Miers F.*	(†)	Dec. 27, 1891
Loomis, Elias	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore	1872	Sept. 10, 1897
Mahan, D. H	(†)	Sept. 16, 1871
Marsh, G. P	1866	July 23, 1882
Marsh, O. C.*	1874	Mar. 18, 1899
Mayer, Alfred M.*	1872	July 13, 1897
Mayo-Smith, Richmond*	1890	Nov. 11, 1901
Meek, F. B	1869	Dec. 21, 1877
Meios, M. C	1865	Jan. 2, 1892
Mitchell, Heney*	1885	Dec. 1, 1902
Moroan, Lewis H	1875	Dec. 14, 1881
Morton, Henry*	1874	May 9, 1902
Newberry, J. S	(†)	Dec. 7, 1892
Newcomb, Simon*	1869	July 11, 1909
Newton, H. A	(†)	Aug. 1, 1896
Newton, John	1876	May 1, 1895
Norton, William A	1873	Sept. 21, 1883
Oliver, James E	1872	Mar. 27, 1895
Packard, A. S.*	1872	Feb. 14, 1905
Penfield, Samuel L	1900	Aug. 13, 1906
Peters, C. H. F.*	1876	July 18, 1890
Pourtales, L. F	1873	July 19, 1880
Powell, John W.*	1880	Sept. 23, 1902
Rodgers, John	(†)	May 5, 1882
Rogers, Fairman	(†)	Aug. 23, 1900

*Biographical notices have not been presented of those designated by an asterisk.

†Charter members, March 3, 1863.

	Date of election.	Date of death.
Rogers, Robert E	(†)	Sept. 7, 1884
Rogers, Wm. A	1885	Mar. 1, 1898
Rogers, William B	(†)	May 30, 1882
Rood, Ogden N	1885	Nov. 12, 1902
Rowland, Henry A	1881	Apr. 16, 1901
Rutherford, Lewis M	(†)	May 30, 1892
Saxton, Joseph	(†)	Oct. 26, 1873
Schott, Charles A.*	1872	July 31, 1901
Sellers, William *	1873	Jan. 24, 1905
Silliman, Benj., Sr	(†)	Nov. 24, 1864
Silliman, Benj., Jr.*	(†)	Jan. 14, 1885
Smith, J. Lawrence	1872	Oct. 12, 1883
Stimpson, William *	1868	May 26, 1873
Strong, Theodore	(†)	Feb. 1, 1869
Sullivant, W. S	1873	Apr. 30, 1882
Torrey, John	(†)	Mar. 10, 1873
Totten, J. G	(†)	Apr. 22, 1864
Trowbridge, William P	1872	Aug. 12, 1892
Trumbull, James H.*	1872	Aug. 5, 1897
Tuckerman, Edward	1868	Mar. 15, 1886
Walker, Francis A	1878	Jan. 5, 1897
Warren, G. K	1876	Aug. 8, 1882
Watson, James C	1868	Nov. 23, 1880
Watson, Sereno	1889	Mar. 9, 1892
Winlock, Joseph	(†)	June 11, 1875
Woodward, J. J	1873	Aug. 17, 1884
Worthen, A. H	1872	May 6, 1888
Wyman, Jeffries	(†)	Sept. 4, 1874
Young, Charles A	1872	Jan. 3, 1908

* Biographical notices have not been presented of those designated by an asterisk.

† Charter members, March 3, 1863.

DECEASED FOREIGN ASSOCIATES.

Adams, J. C.
Airy, Sir George B.
Argelander, F. W. A.
Baer, Karl Ernest von.
Barrande, Joachim.
Beaumont, L. Elie de.
Becquerel, Henri.
Berthelot, M. P. E.
Bertrand, J. L. F.
Boltzmann, Ludwig.
Boussingault, J. B. J. D.
Braun, Alexander.
Brewster, Sir David.
Bunsen, Robert W.
Burmeister, C. H. C.
Candolle, Alphonse de.
Cayley, Arthur.
Chasles, Michel.
Chevreul, M. E.
Clausius, Rudolph.
Cornu, Alfred.
Dove, H. W.
Dumas, J. B.
Farraday, Michael.
Gegenbaur, Karl.
Gyldén, Hugo.
Hamilton, Sir William Rowan.
Helmholtz, Baron H. von.
Hofmann, A. W.
Huxley, T. H.
Ibañez, Carlos.
Janssen, J.
Joule, James P.
Kekulé, August.
Kelvin, Lord.
Kirchoff, G. R.
Kohlrausch, Friedrich.
Kölliker, Albert von.
Lacaze-Duthiers, Henri de.
Leuckart, Rudolph.
Lie, Sophus.
Liebig, Justus von.
Loewy, Maurice.
Ludwig, K. F. W.
Marey, E. J.
Mendeléeff, D. I.
Milne-Edwards, Henry.
Moissan, Henri.
Murchison, Sir Roderick I.
Oppolzer, Theodore von.
Owen, Sir Richard.
Pasteur, Louis.
Peters, C. A. F.
Plana, G. A. A.
Rammelsberg, C. F.
Regnault, Victor.
Reymond, Emil Du Bois.
Richthofen, F. von.
Sachs, Julius von.
Stas, Jean Servais.
Stokes, Sir George G.
Struve, Otto von.
Sylvester, J. J.
Tisserand, F. F.
Virchow, Rudolph von.
Vogel, H. C.
Weierstrass, Karl.
Wöhler, Friedrich.
Würtz, Adolph.
Zittel, K. A. R. von.

O

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1910

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

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LETTER OF TRANSMITTAL.

National Academy of Sciences,
Office of the President,
Washington, D. C., February 11, 1911.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the year ending December 31, 1910.

Very respectfully,
Ira Remsen, *President.*

The President of the Senate.

ACT OF INCORPORATION.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and regulations; to fill all vacancies created by death, resignation, or

otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AMENDMENTS.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said academy as provided in said act.

Approved, July 14, 1870.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

ANNUAL REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

MEETINGS OF THE NATIONAL ACADEMY.

During the year 1910 the academy held two stated meetings. The first was the regular annual meeting held at Washington, April 19 to 21, inclusive; the second, the autumn meeting, held at St. Louis, November 8 to 10, inclusive.

ANNUAL MEETING.

BUSINESS SESSIONS.

The business sessions were held at the Smithsonian Institution, Washington, D. C., April 19 to 21, 1910.

The following members were present during the meeting: Messrs. Abbot, Ames, Becker, Billings, Boss, Brewer, Brush, Chandler (C. F.), Cattell, Clark (W. B.), Clarke (F. W.), Clarke (J. M.), Comstock (G. C.), Coulter, Crafts, Crew, Cross, Dall, Davis, Emmons, Gill, Hague, Hale, Hillebrand, Holmes, Lindgren, Mall, Merriam, Minot, Mitchell, Morley, Morse (E. S.), Morse (H. N.), Nef, Nichols (E. L.), Noyes (A. A.), Peirce (B. O.), Putnam, Remsen, Thomson, Trelease, Walcott, Webster, Welch, Wheeler, and Woodward.

REPORT OF THE HOME SECRETARY.

THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 19, 1910.

The annual report of the president of the academy for the year 1909 was transmitted to the United States Senate January 18, 1910, through the courtesy of Senator George P. Wetmore. The usual edition of 2,000 copies authorized by Congress was printed—500 copies for the Senate, 1,000 copies for the House, and 500 copies for distribution by the Academy of Sciences. The report was received from the Government Printing Office March 28. Nearly one-half of the edition has been distributed to members of the academy, foreign associates, and such libraries and institutions as are on our domestic exchange list.

Messrs. Albrecht Penck, of Berlin, Germany; Gustaf Retzius, of Stockholm, Sweden; Wilhelm Waldeyer, of Berlin, Germany; and Wilhelm Wundt, of Leipzig, Germany, were elected foreign associates of the academy at the annual meeting in April, 1909.

Messrs. Joseph S. Ames, Maxime Bôcher, Oskar Bolza, F. W. Clarke, J. M. Clarke, J. M. Coulter, Henry Crew, Waldemar Lindgren, Thomas H. Morgan, and Henry L. Wheeler were elected members of the academy at the annual meeting in April, 1909.

The following biographical memoirs were published during the year and included in volume 6 of the Biographical Memoirs of the National Academy of Sciences: Josiah Willard Gibbs, by Charles S. Hastings; Elliott Coues, by J. A. Allen; and Ogden Nicholas Rood, by Edward L. Nichols. This volume, which contains 18 memoirs, has been distributed to all of the institutions on the domestic exchange list. The following biographical memoirs have been published as the first three memoirs in volume 7: Wolcott Gibbs, by F. W. Clarke; William Keith Brooks, by E. G. Conklin; and Charles Augustus Young, by E. B. Frost.

The secretary desires to call attention to the fact that at the time the academy came into possession of the album of portraits of the members of the academy collected by Dr. Marcus Benjamin, it owned a complete set of such pictures of its members from its organization in 1863 up to 1907. Since that date recently elected members have neglected to present the academy with a suitable photograph and accompanying autograph. It is earnestly desired that members who have not already done so furnish the secretary, for the academy archives, copies of photographs, engravings, or etchings of themselves. All members who have recently obtained good likenesses would confer a favor by forwarding to the academy a copy of such pictures.

The tables of the Watson asteroids, which have been prepared under the direction of Prof. A. O. Leuschner by means of an appropriation from the Watson fund, are now in page proof, and will soon be issued. The delay in publication was caused by the absence of Prof. Leuschner in Europe and the illness and death of Prof. Newcomb.

Three members have died during the past year: Simon Newcomb, on July 11, 1909. Samuel W. Johnson, on July 21, 1909, and Alexander Agassiz, on March 27, 1910; Friedrich Kohlrausch, an honored foreign associate, died January 17, 1910. There are now 111 active members on the membership list, 1 honorary member, and 44 foreign associates.

Arnold Hague, *Home Secretary*.

April 19, 1910.

REPORT OF THE TREASURER.

The President of the National Academy of Sciences.

Sir: I have the honor to transmit herewith my report as treasurer of the National Academy of Sciences for the year ending April 19, 1910:

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	J. Lawrence Smith fund.
Balance brought forward:					
Cash	$972.37	$160.91	$650.70	$638.04	$999.87
Invested income	5,000.00	5,446.64	4.00	260.12	830.07
Receipts:					
Interest	620.07	2,557.71	1,235.08	518.74	514.52
Members' tax	590.00				
Total	7,182.44	8,165.26	1,889.78	1,416.90	2,344.46
Disbursements	1,294.92	2,195.89	396.18	28.50	814.40
Balance:					
Cash	1,887.52	1,522.73	1,493.60	628.28	699.99
Invested income	4,000.00	4,446.64		760.12	830.07
Total	7,182.44	8,165.26	1,889.78	1,416.90	2,344.46

Income.	Gould fund.	Emmons and Gill, trustees.	Gibbs fund.	Building fund.	Comstock fund.	Marsh fund.
Balance brought forward:						
Cash	$1,713.41	$494.70	....	$145.93	$604.28	....
Invested income	1,500.00	....	....	....	....	....
Receipts:						
Interest	1,076.12	50.00	$79.53	95.00	435.00	$31.25
Members' tax	....	....	....	....	....	....
Total	4,289.53	544.70	79.53	240.93	1,039.28	31.25
Disbursements	2,232.02	544.70	....	9.40	19.23	10.07
Balance:						
Cash	157.51	....	79.53	31.53	420.05	21.18
Invested income	1,900.00	....	....	200.00	600.00	....
Total	4,289.53	544.70	79.53	240.93	1,039.28	31.25

S. F. Emmons, *Treasurer*.

April 19, 1910.

The treasurer's report was referred to an auditing committee composed of Messrs. Gill and Dall, who, after due examination, reported as follows:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer; also that they have examined the securities and papers contained in the box of the academy at the American Security and Trust Co.'s building, and have found them to correspond to the list furnished by the treasurer.

The treasurer made a statement as to the final apportionment among the trust funds of the account which has been carried under the name "Emmons and Gill, trustees." He also stated that the Wolcott Gibbs fund had been restored to its full amount.

STATEMENT OF THE BOARD OF DIRECTORS OF THE BACHE FUND.

(Apr. 15, 1910.)

Since the last stated meeting of the academy, April, 1909, the directors have made the following appropriations:

November, 1909. John Trowbridge	$500
For the study of matter, especially steel, submitted to very great pressure.	
January, 1910. George C. Comstock	1,200
For committee of Astronomical Society, for observations on Halley's comet.	
February, 1910. Henry F. Osborn	500
For the academy committee on correlation of geological horizons (second and final appropriation).	
Total	2,200

Respectfully submitted.

Seth C. Chandler, *Chairman*.

REPORT OF THE TRUSTEES OF THE WATSON FUND.

For some years the income of the Watson fund has been devoted to computing tables of the minor planets discovered by Prof. James C. Watson. This work has been undertaken by Prof. Armin O. Leuschner, of the University of California, and the several appropriations made since 1901 were to enable him to defray expenditures incurred for computing and for miscellaneous expenses. In 1908 Prof. Leuschner placed in the hands of Prof. Newcomb, then chairman of the Watson fund, the completed tables for 12 of the Watson planets, in a manuscript designed for printing. The impending absence of Prof. Newcomb in Europe and the subsequent departure of Prof. Leuschner for Europe, where he was to pass his sabbatical year, prevented progress upon the publication until the autumn of 1909. At last reports the manuscript was all in type, and the early publication of this work is shortly to be anticipated.

The sum of $147.95 has been expended since September last to defray incidental expenses in connection with proof reading for the volume described.

The balance of income which existed in 1901, when this work was begun, together with accumulations since that time, was exhausted in 1908, and there has been a suspension of computations for two years.

Estimates from Prof. Leuschner indicate, in his judgment, that the work can be completed on all nine remaining small planets within 12 to 14 months from September 1, 1910, at an average expenditure of $220 per month. There would be two computers who have already received a thorough training in this difficult class of computations. Prof. Leuschner wishes to resume work on September 1, 1910. Examinations show that the state of the Watson fund warrants the undertaking on the basis described.

The trustees therefore recommend that the expenditure of $2,700, or so much thereof as may be necessary, be authorized at present in order to carry out the arrangement with Prof. Leuschner, already described, in relation to completing the tables for minor planets discovered by Prof. James C. Watson.

LEWIS BOSS, *Chairman.*

REPORT OF THE COMMITTEE ON THE HENRY DRAPER FUND.

The committee on the Henry Draper fund unanimously recommends to the academy that the Draper medal be awarded to Mr. Charles Greeley Abbot, director of the Smithsonian Astrophysical Observatory, for his researches on the infra-red region of the solar spectrum and his accurate measurements, by improved devices, of the solar "constant" of radiation.

Mr. Abbot began his work of investigation as an assistant to the late Dr. Langley, whose invention of the bolometer had provided a means of recognizing and recording radiations of great wave-lengths, invisible to the eye, and producing no impression upon the photographic plate. Through devices perfected by Mr. Abbot, the troublesome "drift" of the galvanometer needle, experienced in all previous work with the bolometer, has been practically eliminated. The latest bolographs of the solar spectrum, made automatically with apparatus constructed after his designs, are of remarkable perfection. They include both the visible spectrum and the ultra-violet, in addition to that extensive region in the infra-red which is known to us only through the work of the Smithsonian Astrophysical Observatory.

As the duties of administration left Secretary Langley little opportunity for research, he confined the immediate direction of the Smithsonian Observatory to Mr. Abbot, who made excellent use of his opportunities. Finding the conditions for solar observation to be exceptionally favorable in California, Mr. Abbot went to Mount Wilson to determine the solar "constant" of radiation. In this research the heating effect of the sun's rays is measured by novel and ingenious forms of pyrheliometers devised by Mr. Abbot, while the absorption of the earth's atmosphere in all parts of the spectrum is determined with the bolometer. The success of this method of correcting for the atmosphere absorption is demonstrated by the fact that values of the solar "constant," determined simultaneously in Washington near sea level and on Mount Wilson and Mount Whitney at elevations of 5,800 feet and 14,500 feet, respectively, are in very close agreement.

The results of several continuous series of observations, made in the course of Mr. Abbot's expeditions to Mount Wilson, have indicated solar fluctuations as great as 10 per cent. As the method is so highly perfected as to show clearly variations of 2 or 3 per cent, due to the ellipticity of the earth's orbit, these irregular fluctuations are probably to be attributed to actual changes in the sun, and not to errors of measurement or to changes in the earth's atmosphere.

In view of the foregoing work, and of other investigations described in Volumes I and II of the Annals of the Smithsonian Astrophysical Observatory, the committee on the Henry Draper fund feels that Mr. Abbot fully deserves to receive the Draper medal.

Respectfully submitted.

George E. Hale, *Chairman.*
W. W. Campbell.
A. A. Michelson,
John Trowbridge.
A. W. Wright.

REPORT OF THE COMMITTEE ON THE J. LAWRENCE SMITH FUND.

To the National Academy of Sciences:

During the year the committee on the J. Lawrence Smith fund have received two applications for grants from the fund, which were reported to the academy with our recommendation at the meeting in November last. The academy voted to give $400 to Dr. E. O. Hovey, of the American Museum of Natural History, and to give a like sum to Prof. C. C. Trowbridge, of Columbia University. Both investigations are in progress, but it is not yet time to expect any report from them.

Respectfully submitted.

Edward W. Morley, *Chairman.*

April 19, 1910.

REPORT OF THE BOARD OF DIRECTORS OF THE B. A. GOULD FUND.

Since the date of the last report (Apr. 20, 1909) the following appropriations have been made:

For the Astronomical Journal	$1,000
Prof. C. L. Doolittle, to provide for assistance in computations, etc., upon his observations made at the Flower Observatory in continuance of the simultaneous series with the zenith-tube and zenith-telescope for investigating the aberration of the fixed stars and change of latitude	1,000
Honorarium to Prof. Henry S. Peck, of Syracuse University, for computation of the definitive orbit of a comet	100
Honorarium to Dr. Frank E. Ross, of the International Latitude Station at Gaithersburg, Md., for computation of the definitive orbit of a comet	100
Total	2,200

In November, 1909, the directors of the Gould fund, with the approval of the donor, unanimously passed the following minute:

"Whereas the Astronomical Journal has been turned over to the Dudley Observatory by its former editor, Dr. S. C. Chandler; and whereas the fund provided by Dr. Gould for meeting deficiencies in its income has been exhausted, we, the directors of the Gould fund, hereby declare our intention to appropriate from time to time, up to the limit of the available income of the Gould fund, whatever may be needed to meet the deficiency of income in the publication of the Journal, and until adequate provision for meeting such deficiency may be otherwise made."

All of which is respectfully submitted.

Lewis Boss, *Chairman.*
S. C. Chandler.
George William Hill.

April 19, 1910.

REPORT OF THE COMMITTEE ON THE BARNARD MEDAL.

To the Council of the National Academy of Sciences:

Your committee appointed to recommend a nominee for an award of the Barnard medal of Columbia University begs leave to submit the following report:

The conditions under which the Barnard medal may be bestowed are specified in the following regulations provided by Columbia University in conformity with the will of Dr. Frederick A. P. Barnard, who was one of the founders of the academy and president of Columbia College from 1864 to the time of his death, in 1889:

"A gold medal of the value of $200, established by the provisions of the will of President Barnard and endowed by him, known as the 'Barnard medal for meritorious service to science,' is awarded quinquennially to such person, if any, whether a citizen of the United States or any other country, as shall within the five years next preceding have made such discovery in physical or astronomical science, or such novel application of science to purposes beneficial to the human race, as in the judgment of the National Academy of Sciences of the United States shall be esteemed most worthy of such honor."

By reason of the limitations of these conditions and by reason of the number of emeinnt investigators whose contributions to science required consideration, the duty of your committee has been beset by many difficulties. It is an instructive and gratifying indication of the current activity and progress in physical science that no less than half a dozen of the investigators considered have produced work in all respects worthy of the distinction contemplated by the founder of the medal in question.

Bearing in mind, however, the precise conditions quoted above, your committee concludes, and hereby recommends, that the Barnard medal for the five-year period ending with the year 1909 be conferred upon Ernest Rutherford, D. Sc., LL. D., F. R. S., now Langworthy professor of physics and director of the physical laboratory in the University of Manchester, for meritorious services to science resulting especially from his investigations of the phenomena of radio-active materials.

Prof. Rutherford has been identified with this branch of physical science since its inception by the discovery of the so-called X rays in 1895. His researches, published in numerous communications to current journals, appear to have contributed more than those of any contemporary to the establishment of the salient properties of radioactive substances. Not content with the experimental determination and verification of these properties, he has recently gone further and pointed out the convincing evidence they afford of the correctness of the ancient doctrine of the atomic structure of matter. In addition to his contributions in this field of investigation of many original, ingenious, and penetrating methods of observation and measurement, he has also furnished the best general account of its origin, development, and present status in his book on Radio-active Transformations (published in 1906) and in his presidential address read before the section of mathematics and physics of the British Association for the Advancement of Science, in August, 1909.

The fertility in experimental methods and in definitive results shown by Prof. Rutherford may be sufficiently indicated here by reference to his recent determination of the number of molecules in a cubic centimeter of helium gas under specified conditions of pressure and temperature. By two independent methods, one electrical and one optical, he has been able to actually count the number of individual Alpha particles entering a suitable detecting vessel per unit of time, and hence to determine that the number of such particles in a cubic centimeter of helium gas under standard pressure and temperature is 25.6 x 10^{18}.

The bearing of his researches and the results he has attained on the kinetic theory of gases and on the atomic and electronic theories of matter is of the highest importance. It seems not too much to assert that in the line of direct experimental evidence on these theories his researches are unequaled.

It is a noteworthy fact, illustrating at once the concentration of effort and the trend of development in molecular physics, that the three previous awards of the Barnard medal have all been made to investigators in this general field of inquiry, namely, to Rayleigh and Ramsay in 1895, to Röntgen in 1900, and to Becquerel in 1905. In the opinion of your committee the work of Prof. Rutherford is not less worthy of this high distinction than the work of his eminent contemporaries upon whom the same honor has been conferred.

Very respectfully submitted.

R. S. Woodward, *Chairman.*
W. W. Campbell.
E. F. Nichols.
A. A. Noyes.
T. W. Richards.

REPORT OF THE BOARD OF DIRECTORS OF THE GIBBS FUND.

The trustees of the Wolcott Gibbs fund have the honor to report that the fund is still accumulating.

C. L. Jackson, *Chairman.*

MARSH FUND.

The home secretary read the following letter from Mr. W. W. Farnam, executor of the estate of O. C. Marsh:

New Haven, Conn., *November 17, 1909.*

Prof. S. F. Emmons,
Treasurer of the National Academy of Sciences,
Washington, D. C.

Dear Sir: I think you are perhaps already aware that the late Prof. O. C. Marsh left a bequest to the National Academy of Sciences. The seventh clause of his will is as follows:

"I give, devise, and bequeath to the corporation known as the National Academy of Sciences, in Washington, D. C., the sum of $10,000, as a trust fund, the income to be used and expended by it for promoting original research in the natural sciences."

When Prof. Marsh died he was somewhat in debt, and we have just succeeded in paying the last of his notes, and have a small balance over, so are sending you with this a check for $1,250 as a first payment of the above legacy. We hope later to be able to pay the whole amount, as we receive from time to time certain moneys from the George Peabody estate, as certain trusts fall back into that estate, and it is probable that the amount still to be received from that source will be enough to do this. Will you kindly acknowledge the receipt of this payment, and at a later date send us the acceptance of the academy of the above trust? With great respect, I am, sir,

Very truly, yours,

Wm. W. Farnam,
Executor Estate of O. C. Marsh.

On the recommendation of the council the following resolutions were adopted:

Resolved, That the trust fund left to the academy by Prof. O. C. Marsh be accepted.

Resolved, That the trust fund left to the academy by Prof. O. C. Marsh be allowed to accumulate until it shall amount to $10,000 before any use shall be made of it.

AGASSIZ FUND.

The home secretary read a letter from Mr. Rudolph Agassiz, announcing the bequest to the academy by Mr. Alexander Agassiz of the sum of $50,000.

REPORT OF THE COMMITTEE ON INTERNATIONAL COOPERATION IN RESEARCH.

The duties of this committee, as expressed in resolutions adopted by the academy in April, 1908, are as follows:

(1) To keep in close touch with the work of the International Association of Academies, and to assist in securing suitable representation of the academy at the council and general meetings of the association.

(2) To consider plans for cooperation in research and to recommend from time to time the initiation of such cooperative investigations as may warrant the support of the academy.

The chairman, appointed by President Remsen to represent the National Academy, attended the council meeting of the International Association of Academies at Rome in June, 1909. It was decided by the council that the admission to the association of the Swiss Society of Natural Sciences be voted on at the triennial meeting of the association at Rome in May, 1910. After examining the status of this society, your committee recommends that the delegate of the National Academy be instructed to vote in favor of the admission of the Swiss Society to the Association of Academies.

The committee has also considered a project for the publication of Annual Physical-Chemical Tables, to be prepared by an international committee appointed by the Seventh International Congress of Applied Chemistry. An outline of the proposed plan is shown by the statement appended hereto.

Your committee recommends that the academy be asked to express its indorsement of this publication, and that its delegate at Rome be instructed to vote in the affirmative in case the plan is presented to the International Association of Academies for its indorsement.

Your committee has received reports from the various special committees of the academy on cooperative research, including those dealing with the study of the brain, international paleontologic correlation, chemistry, and solar research. These reports have been presented to the academy by the respective committees.

Respectfully submitted.

George E. Hale, *Chairman.*

ANNUAL PHYSICAL-CHEMICAL TABLES.

The Annual Physical-Chemical Tables will have for their object the collection of all constants and numerical data which may possibly be of interest in connection with physics or chemistry, or with the technical applications of these sciences. They will form in a sense a continuation or extension of the various tables which already exist (e. g., those of Landolt and Börnstein); or, rather, they will serve as a complete storehouse of data, from which in the future new tables of a general or special nature could be compiled or by means of which existing tables could be brought up to date.

They will become a powerful aid to the work of the investigator, of the scholar, and of the technical man, by enabling him to find with ease the data which he may require and which he might possibly be quite unable to obtain by individual search through the literature.

Based, as they will be, on a methodical process of abstracting all the existing periodicals connected in any way with physics or chemistry, the Annual Physical-Chemical Tables will be the means of saving from oblivion numberless useful measurements of a subsidiary character, whose existence can not be inferred from the titles of the papers containing them.

The data to be brought together in the tables will be classified under the following heads: [1]

I. *General physics.*—(Gravitation constant, modulus of rigidity, compressibility, breaking stress, hardness, coefficient of friction, density, surface tension, etc.)

II. *Heat.*—(Coefficients of linear and cubical expansion, melting point, boiling point, vapor pressure, specific heat, latent heat of fusion, latent heat of vaporization, thermal conductivity, etc.)

III. *Electricity and magnetism.*

(*a*) *General properties.*—(Dielectric constant, dielectric strength, thermoelectric power, conductivity and resistivity, magnetic permeability and susceptibility, etc.)

(*b*) *Electric conduction in gases.*—(Disruptive potential, mobility of ions, charge on the ions, coefficient of recombination, etc.)

(*c*) *Radio-activity.*—(Activity, average life, rate of decay, heat evolved, coefficient of absorption, etc.)

IV. *Light and sound.*—(Wave-length, index of refraction, coefficient of absorption, rotatory power, emissive power, constants of the laws of radiation, velocity of sound, etc.)

V. *Physical chemistry.*

(*a*) *General chemistry and chemical mechanics.*—(Atomic weight, solubility, coefficient of diffusion, transition temperature, etc.)

(*b*) *Electro-chemistry.*—(Electrode potential, decomposition potential, electro-chemical equivalent, equivalent and molecular conductivity, dissociation constant, mobility, transport number, etc.)

(*c*) *Thermo-chemistry.*—(Heat of solution, heat of dilution, heat of hydration, heat of ionization, heat of neutralization, heat of formation, heat of combustion, calorific value, etc.)

Every value given in the tables will be accompanied by the name of the author, by a reference to the original paper, and by an indication of the conditions (temperature, pressure, etc.), under which the measurement was made.

The above summary, short as it is, should be sufficient to give some idea of the importance of the task which has been intrusted to the international commission by the Seventh Congress of Applied Chemistry.[2]

The general organization is now well advanced, and the work of abstracting has begun in all the countries represented, under the direction of their respective delegates.

The first volume of the tables will be published early in 1911, and will contain all data published during 1910.

THE INTERNATIONAL COMMITTEE OF PUBLICATION
ANNUAL PHYSICO-CHEMICAL TABLES.

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[1] This abridged classification is given merely as an illustration. In practice it will be enlarged and modified.

[2] The various countries are represented on the commission by the following persons: Austria, Prof. Rothmund; Belgium, Prof. Spring; British Empire, Drs. Findlay and Wilsmore; Denmark, Norway, and Sweden, Dr. Lunden; France, Dr. Marie and Prof. Urbain; Germany, Profs. Abegg and Bodenstein; Holland, Prof. Cohen; Italy, Profs. Bruni and Carrara; Russia, Profs. Kistiakowski and Walden; Spain, Dr. Mourelo; Switzerland, Prof. Dutoit; United States, Profs. Bancroft and Lewis.

REPORT OF THE COMMITTEE ON SOLAR RESEARCH.

The committee on solar research begs to report that the work of the International Union for Cooperation in Solar Research, organized through the initiative of the National Academy, is progressing satisfactorily. A preliminary meeting, held on the occasion of the St. Louis Scientific Congress in 1904, was followed by largely attended conferences at Oxford, in 1905, and Paris, in 1907. Invitations for the next conference, which is to be held on Mount Wilson during the period August 29–September 6 next, were issued in December. Acceptances from 35 European astronomers and physicists have already been received, and a large American attendance is assured. It is hoped that many of the foreign delegates will take part in the meeting of the Astronomical and Astrophysical Society at the Harvard Observatory and travel together by special train to California.

The following societies are now represented in the Solar Union by committees: The Academies of Amsterdam, Barcelona, Paris, St. Petersburg, Stockholm, and Vienna; the Royal Society of London, the National Academy of Sciences, the Astronomical Societies of America, France, and London; the Physical Societies of America, France, Germany, Italy, and Spain; the Swiss Society of Natural Sciences, the Society of Italian Spectroscopists, the Solar Physics Committee of London, and the International Meteorological Committee.

The chief work of the union is undoubtedly the stimulation of interest in solar research and the encouragement of workers in this field. It has brought together astronomers and physicists on common ground, thus contributing toward the solution of problems lying on the borderland between these subjects. The influence of the union seems to be apparent in the marked activity which has resulted in many recent additions to our knowledge of the sun. But it has also accomplished much in other ways. The establishment of a new system of wave lengths, based on Michelson's determination of the absolute wave length of the green cadmium line, and the measurements of standard lines already made by Fabry and Buisson, Eversheim, and Pfund, will be of lasting benefit to exact science. The daily photography of the sun, with spectroheliographs in Sicily, France, Spain, Germany, England, Mexico, the United States, and India, will soon be supplemented, it is hoped, by stations in Australia and China, and possibly in Japan. In this way the changing phenomena of the solar atmosphere are recorded from hour to hour. A program for the cooperative study of sun-spot spectra, adopted at Paris, will now be revised to adapt it to the new conditions presented by recent discoveries. The chief progress in the study of the intensity of the solar radiation has come through the work of the Smithsonian Astrophysical Observatory, but the use in Italy, France, and India of standard pyrheliometers sent out by Abbot should soon result in the initiation of a general scheme of cooperation. Adams's discovery that the law of the solar rotation varies at different altitudes in the sun's atmosphere has been confirmed by Pérot, and others are entering this important field. Cooperation in eclipse observations and in other departments of solar research has also been initiated by the union.

Respectfully submitted.

George E. Hale, *Chairman.*

ELIA DE CYON PRIZE.

The home secretary read the following letter in regard to the Elia de Cyon prize:

INTERNATIONAL COMPETITION FOR THE ELIA DE CYON PRIZE.

The class of physical sciences of the Royal Academy of Bologna hereby calls attention to an international competition for a biennial prize of 3,000 lire, established from the income of a generous donation made to the class by one of its corresponding members, Prof. Elia de Cyon, with the object of promoting researches and studies in the subjects which he cultivated with so much success. This reward will be conferred on competitors whose works treat of the same subjects, and particularly those relating to:

(1) The functions of the heart, and, above all, of the cardiac and vaso-motor nervous systems.

(2) The functions of the labyrinth of the ear.

(3) The functions of the thyroid glands, of the hypophyses, and of the pineal gland.

The first prize will be awarded on March 1, 1911.

CONDITIONS OF THE COMPETITION.

[Extract from the regulations approved by royal decree of October 6, 1909.]

ARTICLE 1. An international competition for a prize of 3,000 lire will be held every two years by the class of physical sciences of the Royal Academy of Sciences of the Institute of Bologna, open to the authors of scientific works relating to the studies carried on by the illustrious donor, Prof. Elia de Cyon, especially those relating to:

(*a*) The functions of the heart, and, above all, of the cardiac and vaso-motor nervous systems.

(*b*) The functions of the labyrinth of the ear.

(*c*) The functions of the thyroid glands, of the hypophyses, and of the pineal gland.

ART. 2. The works entered in competition for the prize must be sent to the secretary of the class of physical sciences of the Royal Academy of Sciences of Bologna, via Zamboni 33, with an explicit statement that they are intended for the competition.

ART. 3. The works may be in manuscript or printed, but should not date prior to the period of two years preceding the competition in which they are entered; that is to say, those intended for this first competition must not bear date earlier than March 1, 1909.

ART. 4. The works should be written in the Latin, Italian, French, English, or German language.

ART. 5. The works, if anonymous, should be accompanied by a sealed box containing a note giving the name of the author and bearing on the outside a motto, which is repeated at the head of the manuscript. Only the box relating to the work which draws the prize will be opened, while the other boxes will be burned without opening them.

ART. 6. The competitors may be called upon to repeat their experiments in the presence of the examining committee.

ART. 7. The committee will be composed of three members elected by the class.

ART. 8. The committee itself will be required to report within three months of the close of the competition.

ART. 9. The report of the examining committee will be submitted for the approval of the entire class and may be published in the Comptes-Rendus of the class itself.

ART. 10. The prize will be awarded at a full meeting of the academy, not later than four months after the close of the competition.

ART. 11. The prize can not be awarded more than once to the same person.

ART. 12. The prize is indivisible.

ART. 13. If the work which draws the prize is unpublished, it may be published in the Proceedings of the Class of Physical Sciences if the class thinks it advisable to do so.

ART. 14. The prize can not be awarded to anyone who may hold any kind of membership in the class of physical sciences of the Royal Academy of Bologna.

SEN. AUGUSTO RIGHI, *President.*
ERCOLE GIACOMINI, *Secretary.*

BOLOGNA, *January 16, 1910.*

ACADEMY MEDALISTS.

On the recommendation of the council the following resolution was adopted:

Resolved, That those scientists who receive medals from the academy or upon its recommendation be invited to present at one of the regular meetings of the academy addresses describing their investigations.

BUREAU OF SEISMOLOGY.

The home secretary read a communication from the president of the American Philosophical Society in regard to the establishment of a bureau of seismology.

On the recommendation of the council the academy adopted the following resolution:

Resolved, That the academy strongly approves the establishment of the proposed Seismological Laboratory, and its organization under the direction of the Smithsonian Institution.

SUBDIVISION OF COMMITTEES ON BIOLOGY AND ANTHROPOLOGY.

On the recommendation of the council the academy adopted the following resolution:

Resolved, That the president be authorized to appoint a committee which shall include the chairmen of the committees on nomination of new members in biology and anthropology, and such other members of these committees as he may deem necessary, to take up the question of a more appropriate subdivision of the committees on biology and anthropology.

APPOINTMENT OF DELEGATES.

The president announced the appointment of Mr. E. G. Conklin as a delegate to represent the academy at the International Zoological Congress at Gratz in August and at the meeting of the International Association of Academies at Rome in May; of Mr. Arnold Hague to the one hundredth anniversary of the University of Berlin, October 10–12; and of Mr. S. F. Emmons to the International Geological Congress at Stockholm, August 17–25.

ELECTION OF OFFICERS.

Mr. George E. Hale was elected to succeed Mr. Alexander Agassiz as foreign secretary of the academy for a term of six years.

Messrs. Chittenden and Osborn were elected to serve as members of the council of the academy for three years.

ELECTION OF NEW MEMBERS.

The following men were elected members of the academy: Messrs. D. H. Campbell, of the University of California; John Dewey, of Columbia University, New York City; Jacques Loeb, of the Rockefeller Institute, New York City; F. R. Moulton, of the University of Chicago; W. A. Noyes, of the University of Illinois; T. B. Osborne, of the Agricultural Experiment Station, New Haven, Conn.; and Charles Schuchert, of Yale University.

ELECTION OF FOREIGN ASSOCIATES.

Mr. Giovanni Schiaparelli was elected a foreign associate of the academy.

TRUSTEE OF THE WATSON FUND.

The president announced that he had appointed Mr. Frost to fill a vacancy in the board of trustees of the Watson fund, and that his attention had been later called to the fact that the deed of trust provided for the election of the board of trustees by the academy.

The appointment of Mr. Frost was approved by the academy.

SCIENTIFIC SESSIONS.

The scientific sessions were held in the United States National Museum, Washington, D. C., April 19 to 21, 1910.

April 19.

Solar magnetism. George E. Hale.

On some visual and photographic observations of Mars. George E. Hale.

The distribution of Agave in the West Indies. William Trelease.

The vascular plate and cotyledons of gymnosperms. John M. Coulter.

Some crucial experiments demonstrating the necessity of accepting the one-fluid theory in electricity. F. E. Nipher (introduced by William Trelease).

A probable indirect relation between solar disturbances and terrestrial temperatures. W. J. Humphreys (introduced by Cleveland Abbe).

Quantitative studies of tuning forks. E. A. Harrington (introduced by A. G Webster).

A new method for the study of elastic hysteresis. A. G. Webster.

April 20.

The 16-inch Metcalf doublet. E. C. Pickering.

The Bureau of Standards. S. W. Stratton. (By invitation of the local committee.)

The determination of temperature constants in mineral formations. Arthur L. Day. (By invitation of the local committee.)

A new form of gas thermometer and the boiling points of water and naphthalene. J. M. Crafts.

The temperature coefficient of osmotic pressure. H. N. Morse.

Hydraulics of the Chagres River. H. L. Abbot.

The development of Olenellus. C. D. Walcott.

A new development of mudlump activity at the mouth of the Mississippi River. E. W. Hilgard.

April 21.

The Austral Devonian. J. M. Clarke.

Denudation evidence in relation to the age of the earth. George F. Becker.

The influence of environment upon human types. Franz Boas.

On the spectrum of Mars as photographed with high dispersion. W. W. Campbell and Sebastian Albrecht.

Read by Title.

The correlation of the Pleistocene of Europe and North America. H. F. Osborn.

The epidermal covering of the trachodont dinosaurs. H. F. Osborn.

Report of progress in the study of the Miocene ungulates of Patagonia. W. B. Scott.

Quandaries following from the theory of isostasy. W. M. Davis.

Composition of American river waters. R. B. Dole. (Introduced by F. W. Clarke.)
A preliminary study of chemical denudation. F. W. Clarke.
The ionization relations of poly-ionic salts. A. A. Noyes.
The structural characteristics and relations of the apodals. Theodore Gill.
Recent discoveries of the early history of the common eel. Theodore Gill.
Some studies in molecular rearrangement. Ira Remsen.
The number of double stars as a function of the separation of the component. R. G. Aitken. (Introduced by W. W. Campbell.)
Second catalogue of spectroscopic binary stars. W. W. Campbell.

AUTUMN MEETING.

The autumn meeting was held at St. Louis, Mo., November 8 to 10, inclusive, 1910.

The following members were in attendance at the meeting: Messrs. Chamberlin, Comstock (G. C.), Coulter, Crew, Davis, Hague, Moulton, Nef, Noyes (W. A.), Remsen, Trelease, and Wilson.

BUSINESS SESSIONS.

The business sessions were held at the Missouri Botanical Garden, St. Louis, November 8 and 9, 1910.

FOREIGN SECRETARY.

The home secretary was authorized by vote of the academy to act as foreign secretary during the absence of that officer from the country on account of illness, or until the annual meeting in April, 1911.

J. LAWRENCE SMITH FUND.

In accordance with the recommendation of the committee on the J. Lawrence Smith fund the academy approved a grant of $200 to Dr. George P. Merrill, of the United States National Museum, for a study of the presence or absence of certain elements reported as occurring in small quantities in meteorites.

DEATHS.

The president announced the death, since the last meeting of the academy, of the following members: Messrs. G. F. Barker, W. H. Brewer, C. B. Comstock, and C. A. White.

SCIENTIFIC SESSIONS.

NOVEMBER 8.

Some problems of stellar motion. G. C. Comstock.
Preliminary note on the sun's velocity with respect to stars of spectral type A. E. B. Frost.
A monograph of Agave in the West Indies. William Trelease.
The mode of chromosome reduction. R. R. Gates. (Introduced by Mr. Trelease.)

NOVEMBER 9.

On the origin of binary stars. F. R. Moulton.
The cycadophytes. J. M. Coulter.
The front range of the Rocky Mountains in Colorado. W. M. Davis.
Mutualism, parasitism, and symbiosis. George T. Moore. (Introduced by Mr. Trelease.)

NOVEMBER 10.

Sugar chemistry from the new chemico-physical standpoint, or the behavior of the sugars toward enzymes, alkalies, and oxydizing agents. John U. Nef.

Molecular rearrangements in the camphor series: isocamphoric acid. William A. Noyes and Luther Knight.

A molecular rearrangement leading to the formation of amidines. Ira Remsen.

DEATHS DURING 1910.

Since the appearance of the last annual report six members[1] of the academy have passed away. These are Alexander Agassiz, George F. Barker, Cyrus B. Comstock, C. A. White, William H. Brewer, and C. O. Whitman. Biographical memoirs will be prepared and published later in accordance with the usage of the academy.

ALEXANDER AGASSIZ.

Alexander Agassiz was born at Neuchatel, Switzerland, December 17, 1835, and was the only son of Louis Agassiz. He was brought to America in 1849, and entered the Cambridge High School. He entered Harvard College and was graduated in 1855 with the degree of A. B. and then studied engineering, geology, and chemistry in the Lawrence Scientific School, receiving one degree of B. S. in 1857 and another in natural history in 1862. After graduating from the Lawrence Scientific School he taught until 1859, when he was appointed an assistant in the United States Coast Survey. After a year's service of this kind he returned to Cambridge to continue his zoological studies. He worked here with his father and assisted him from the time the Museum of Comparative Zoology was opened in 1860 until 1866, when he went to Michigan to develop the Calumet and Hecla copper mine. Out of the wealth that came to him through this connection he gave over $1,000,000 to the building up of the museum which his father had founded.

The following paragraph is quoted from an interesting article on Agassiz by Alfred G. Mayer, which appeared in the Popular Science Monthly for November, 1910:

> He never adopted the methods of the histologist, which were not used by his father, and he confined himself to the study of living animals whenever this was possible. Thus it is that he ranks among the foremost of those systematists and embryologists who have devoted themselves to the observation of marine animals, but histology was wholly neglected by him. Nor did he ever take part in that stirring discussion of Darwinism which engrossed the attention of all of his contemporaries. It would be unfair to say that he did not believe in evolution, but the truth is that he was but little interested in the speculative side of science, excepting in so far as its deductions could be based upon the observations of facts. In later life he came to regard the labors of the physiologist and of the laboratory experimenters upon the reactions of animals as beyond the scope of zoology.

He became a member of the National Academy of Sciences in 1866, and was president of the academy from 1901 to 1907, and its foreign secretary from 1891 to 1901 and from 1908 until his death, on March 27, 1910. He bequeathed the sum of $50,000 to the academy.

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[1] Since these biographical notes were prepared two of our members have passed away: H. P. Bowditch on March 13, and S. F. Emmons on March 28.

GEORGE FREDERICK BARKER.

George Frederick Barker was born at Charlestown, Mass., July 14, 1835, and died at Philadelphia, May 24, 1910. He was graduated from the Sheffield Scientific School in 1858. From 1859 to 1861 he served as assistant in the Harvard Medical School. He afterwards taught successively in Wheaton College, Illinois, and in the Albany Medical College. In 1863 he taught in the University of Pittsburg, and in 1868 and 1869 he delivered lectures on chemistry in Williams College. In 1869 he was appointed professor of physiological chemistry and toxicology in the Yale Medical School, going thence, in 1872, to the University of Pennsylvania as professor of physics. In 1900 he was made emeritus professor.

Prof. Barker had to a very unusual degree the power of clear exposition. When the so-called new chemistry, after many struggles, came to be accepted, by the younger generation at least, his Elementary Chemistry appeared, and this undoubtedly helped to spread the new ideas. For a number of years it was in extensive use in colleges.

In 1881 he was United States commissioner to the Electrical Exhibition at Paris and vice president of the jury of awards. In recognition of this service, France made him a commander in the Legion of Honor.

He was elected to the academy in 1876.

CYRUS BALLOU COMSTOCK.

Cyrus Ballou Comstock for more than a quarter of a century has taken an active interest in promoting the objects for which the academy was organized. He was born at West Wrentham, Mass., on February 3, 1831, and was graduated with first honors at the Military Academy at West Point in 1855. He was assigned to the Corps of Engineers, and during the war served with both eastern and western armies on the staff of different commanding generals, terminating with that of Gen. Grant, with whom he continued to hold the confidential position of aid-de-camp for several years after the close of hostilities. Subsequently he was charged with many responsible duties pertaining to the Corps of Engineers, among which for long periods may be named that of Director of the Geodetic Survey of the Northern and Northwestern Lakes, and president of the Mississippi River Commission.

Gen. Comstock took much interest in promoting works of original research; and in 1907, under the act approved June 20, 1884, he donated to the National Academy a trust fund of $10,000 for researches in electricity, magnetism, and radiant energy.

His professional writings were numerous, both personal and as member of important boards and commissions on river and harbor improvements. Among them should be mentioned his final Report on the Primary Triangulation of the United States Lake Survey.

He was elected to the academy in 1884, and died on May 29, 1910.

CHARLES ABIATHAR WHITE.

Charles Abiathar White was born January 26, 1826, at Dighton, Mass. He early moved to Burlington, Iowa, and there began a scientific study of the natural history of that portion of the State. His ability soon received the recognition of Prof. James Hall, who made him his assistant, but after two years upon the New York State survey he took up the study of medicine and returned to Iowa. His practice was interrupted by his appointment to the position of State geologist, the duties of which he assumed in April, 1866. University work at Grinnell, Iowa, and at Bowdoin College, Maine, occupied his time until the year 1876, when he resigned to undertake the study of the invertebrate paleontological collections of the Surveys West of the One Hundredth Meridian, of the Geological Survey of the Rocky Mountain Region, and of the Fortieth Parallel Survey. He was one of the founders of the Geological Society of America, a member of the reorganized United States Geological Survey from 1882 to 1892, a curator in the United States National Museum, and a scientific associate of the Smithsonian Institution from 1895 to his death, on June 29, 1910. He was elected a member of the academy in 1895.

WILLIAM HENRY BREWER.

Prof. Brewer was born in Poughkeepsie, N. Y., September 14, 1828, and died November 2, 1910. He was graduated with the first class of the Yale Scientific School. He afterwards studied with Liebig before studying abroad had become common. In 1858 he was elected professor of chemistry and geology in Washington College. From 1860 to 1864 he served in the California State survey and for a part of this time he was professor of natural science in the University of California. In 1864 he became professor of agriculture in the Sheffield Scientific School of Yale University, in which position he served until 1903, when he was made professor emeritus. He served on many important Government commissions, such as the topographical survey of Connecticut; on cereal productions in the United States (Tenth Census); United States Forestry Commission, 1896; scientific survey of the Philippine Islands, etc.

He became a member of the academy in 1880 and was one of the most regular attendants on the meetings.

CHARLES OTIS WHITMAN.

Charles Otis Whitman was born in Woodstock, Me., on December 14, 1842. After spending a few years under Leuckert at Leipzig he went to the University of Tokyo in 1880, then to the zoological station at Naples, and returned to the United States in 1883 to take up work in the Zoological Laboratory of Harvard University. In 1886 he was appointed director of the Allis Lake Laboratory at Milwaukee, and from 1889 to 1892 he was the head of the department of zoology in the newly founded Clark University. He became the first director of the Marine Biological Laboratory at Woods Hole in 1888, and the head of the department of zoology at the University of Chicago in 1892. He resigned the former position in 1908, but retained his position in the University of Chicago until his death, on December 6, 1910. The latter position called for an administration in harmony with the institution of which it formed a part; the other enabled him successfully to resist the external and internal forces tending to unite the laboratory with any other institution, and it now stands alone, a center of biological research and a monument to the ideals of its first director. While thus called upon to direct the affairs of three institutions (Clark, Chicago, and Woods Hole) during their formative period, he nevertheless found time to exercise a singularly enthusiastic devotion to teaching and personal research, and his publications are masterful contributions to the most fundamental problems of biology. He was elected to the academy in 1895.

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907; November 20, 1907.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SEC. 1. The academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the sessions of the academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

SEC. 3. The academy may elect fifty foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the academy.

ARTICLE II.—OF THE OFFICERS.

SEC. 1. The officers of the academy shall be a president, a vice president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated session after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the session when such vacancy occurs, or at the next stated session thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the academy until the next stated session of the academy.

SEC. 2. The officers of the academy, together with six members to be elected by the academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the academy.

SEC. 3. The president of the academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its sessions next ensuing; and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated sessions in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each session shall be duly engrossed before the next stated session, under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the April session. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

SEC. 1. The academy shall hold one stated session in each year, in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council shall determine.

Special sessions of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Scientific sessions of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each daily meeting shall be recorded in the minutes, and the members present at any meeting shall constitute a quorum for the transaction of business.

SEC. 3. Scientific meetings of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; those for the transaction of business, closed.

SEC. 4. The stated meetings of the council shall be held during the stated or special sessions of the academy. Special sessions may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors to serve for three years shall be elected at the first stated session in each year.

SEC. 4. Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the subject in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

SEC. 5. The academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Election to membership shall be held as described below. There shall be two ballots—a preference ballot, which may be prepared either before or at the meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

1. *Preference ballot.*—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on

this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

2. *Final ballot.*—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 20 votes in all, provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

Election of members shall be held at the regular stated session of each year held in Washington, and not more than 10 members shall be elected at that session.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated session after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council and may be elected at the regular stated session of each year, held in Washington, by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.

Recommendations for nomination of foreign associates may be sent to the home secretary at any time.

SEC. 8. A diploma, with the corporate seal of the academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the academy with the recommendation that

the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific meetings of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the president, with the advice of the council.

SEC. 3. The academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated session.

SEC. 5. The advice of the academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated sessions.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SEC. 1. All investments shall be made by the treasurer, in the corporate name of the academy, in stocks of the United States, or, with the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the academy.

SEC. 2. No contract shall be binding upon the academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the academy shall be fixed by the academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated session of the academy. Notice of a proposition for such a change must be given at a stated session, and shall be referred to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated session, and if it receive two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall be referred to an auditing committee to be appointed by the president at or before the annual meeting. This committee shall also inspect and verify the bonds, securities, and other property in the custody of the treasurer. The report of this committee shall be presented to the academy before the close of the session.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the last day of any session, when a member shall be selected by the president to furnish a biographical notice of the deceased at the next stated session. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the academy.

X. Memoirs shall date, in the records of the academy, from the date of their presentation to the academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the academy as early as practicable, and not later than the next stated session.

XII. The annual report of the academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make

scientific investigations at the request of departments of the Government, and in each case to look to the department requesting the investigation for reimbursement to the academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XIX. All discussions as to the claims and qualifications of nominees at meetings of the academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the academy at the time of the discussion.

XX. Any rule of the academy may be amended, suspended, or repealed on the written motion of any two members, signed by them, and presented at a stated session of the academy, provided the same shall be approved by a majority of the members present.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1910-11.

	Expiration of term.
Remsen, Ira, *President*	April, 1913
Walcott, C. D., *Vice President*	April, 1913
Hale, George E., *Foreign Secretary*	April, 1916
Hague, Arnold, *Home Secretary*	April, 1913
Emmons, S. F., *Treasurer*	April, 1914

ADDITIONAL MEMBERS OF COUNCIL.

1908–1911.

Welch, W. H.

Wilson, E. B.

1909–1912.

Davis, W. M.

Woodward, R. S.

1910–1913.

Osborn, H. F.

Chittenden, R. H.

COMMITTEES OF THE ACADEMY.

1. Mathematics and astronomy.
   - Abbe, C.
   - Bôcher, Maxime.
   - Bolza, Oskar.
   - Boss, Lewis.
   - Campbell, W. W.
   - Chandler, S. C.
   - Comstock, G. C. (*Chairman*).
   - Davidson, G.
   - Elkin, W. L.
   - Frost, E. B.
   - Hale, G. E.
   - Hill, G. W.
   - Holden, E. S.
   - Moore, E. H.
   - Moulton, F. R.
   - Osgood, W. F.
   - Peirce, C. S.
   - Pickering, E. C.
   - Story, W. E.
   - Webster, A. G.
   - Woodward, R. S.
2. Physics and engineering.
   - Abbe, C.
   - Abbot, H. L.
   - Ames, J. S.
   - Barus, C.
   - Bell, A. G.
   - Crew, Henry.
   - Hastings, C. S.
   - Mendenhall, T. C.
   - Michelson, A. A.
   - Morley, E. W.
   - Nichols, E. F.
   - Nichols, E. L.
   - Peirce, B. O.
   - Pickering, E. C.
   - Pupin, M. I.
   - Thomson, Elihu.
   - Trowbridge, J.
   - Webster, A. G.
   - Woodward, R. S. (*Chairman*).
   - Wright, A. W.

3. Chemistry.
   Brush, G. J.
   Chandler, C. F.
   Chittenden, R. H.
   Clarke, F. W.
   Crafts, J. M.
   Dana, E. S.
   Gooch, F. A.
   Hilgard, E. W.
   Hillebrand, W. F.
   Jackson, C. L.
   Michael, A.
   Morley, E. W.
   Morse, H. N.
   Nef, John U.
   Noyes, A. A. (*Chairman*).
   Noyes, W. A.
   Osborne, T. B.
   Remsen, Ira.
   Richards, T. W.
   Smith, E. F.
   Wells, H. L.
   Wheeler, H. L.

4. Geology and paleontology.
   Becker, G. F.
   Branner, J. C.
   Chamberlin, T. C.
   Clark, W. B.
   Clarke, J. M.
   Cross, Whitman.
   Dall, W. H.
   Davis, W. M.
   Dutton, C. E.
   Emmons, S. F.
   Gilbert, G. K.
   Hague, Arnold (*Chairman*).
   Iddings, J. P.
   Lindgren, Waldemar.
   Osborn, H. F.
   Pumpelly, R.
   Schuchert, Chas.
   Scott, W. B.
   Van Hise, C. R.
   Walcott, C. D.

5. Biology.
   Allen, J. A.
   Bowditch, H. P.
   Campbell, D. H.
   Chittenden, R. H. (*Chairman*).
   Conklin, E. G.
   Coulter, J. M.
   Councilman, W. T.
   Dall, W. H.
   Farlow, W. G.
   Gill, T. N.
   Goodale, G. L.
   Howell, W. H.
   Loeb, Jacques.
   Mall, F. P.
   Mark, E. L.
   Merriam, C. H.
   Minot, C. S.
   Morgan, T. H.
   Morse, E. S.
   Osborn, H. F.
   Prudden, T. M.
   Putnam, F. W.
   Sargent, C. S.
   Smith, Theobald.
   Scudder, S. H.
   Trelease, William.
   Verrill, A. E.
   Walcott, C. D.
   Welch, W. H.
   Wilson, E. B.
   Wood, H. C.

6. Anthropology.
   Billings, J. S. (*Chairman*).
   Boas, Franz.
   Cattell, J. McK.
   Dewey, John.
   Flexner, Simon.
   Holmes, W. H.
   Merriam, C. H.
   Minot, C. S.
   Mitchell, S. W.
   Morse, E. S.
   Peirce, C. S.
   Putnam, F. W.
   Royce, Josiah.
   Welch, W. H.

ON WEIGHTS, MEASURES, AND COINAGE.

Mendenhall, T. C., *Chairman*.
Michelson, A. A.
Webster, A. G.
Morley, E. W.
Peirce, C. S.
Woodward, R. S.

ON PUBLICATION.

The President.
The Home Secretary.
Walcott, C. D.

ON SOLAR RESEARCH.

Hale, George E., *Chairman*.
Michelson, A. A.
Comstock, G. C.
Campbell, W. W.
Nichols, E. L.

TRUST FUNDS.

BOARD OF DIRECTION OF THE BACHE FUND.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Chandler, S. C., *Chairman*.
Remsen, Ira.
Minot, C. S.

BOARD OF TRUSTEES OF THE WATSON FUND.

[1883, residual estate, $18,666.88.]

For the promotion of astronomical research.

Boss, Lewis, *Chairman*.
Elkin, W. L.
Frost, E. B.

THE HENRY DRAPER FUND.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Hale, George E., *Chairman*.
Trowbridge, John.
Wright, A. W.
Campbell, W. W.
Michelson, A. A.

THE J. LAWRENCE SMITH FUND.

[1885, $8,000.]

For the investigation of meteoric bodies.

Morley, E. W., *Chairman*.
Dana, E. S.
Hague, Arnold.
Pumpelly, R.
Remsen, Ira.

THE BENJAMIN APTHORP GOULD FUND.

[1897, $20,000.]

For researches in astronomy.

Boss, Lewis, *Chairman*.
Chandler, S. C.
Hill, G. W.

THE BARNARD MEDAL.[1]

For meritorious service to science.

Woodward, R. S., *Chairman*.
Campbell, W. W.
Noyes, A. A.
Nichols, E. F.
Richards, T. W.

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[1] Every five years the committee recommends the person whom they consider most deserving of the medal, and upon the approval of the academy the name of the nominee is forwarded to the trustees of Columbia College, who administer the Barnard medal fund.

THE WOLCOTT GIBBS FUND.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman.* Remsen, Ira. Smith, Edgar F.

THE COMSTOCK TRUST FUND.

[1907, $10,000.]

For researches in electricity, magnetism, and radiant energy.

Nichols, E. L., *Chairman.* Noyes, Arthur A. Thomson, Elihu.
Hale, Geo. E. Webster, A. G.

THE MARSH TRUST FUND.

[1909, $1.250.]

For promoting original research in the natural sciences.

JOSEPH HENRY FUND.

To assist meritorious investigators, especially in the direction of original research.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, MARCH 1, 1911.

		Date of election.
Abbe, Cleveland	*U. S. Weather Bureau, Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley St., Cambridge, Mass.*	1872
Allen, J. Asaph	*American Museum of Natural History, New York City.*	1876
Ames, Joseph S	*Johns Hopkins University, Baltimore, Md.*	1909
Barus, Carl	*Brown University, Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Bell, A. Graham	*1331 Connecticut Ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first St., New York City.*	1883
Boas, Franz	*123 W. Eighty-second St., New York City.*	1900
Bôcher, Maxime	*Harvard University, Cambridge, Mass.*	1909
Bolza, Oskar	*Marienstrasse 7, Freiburg, Germany.*	1909
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Bowditch, Henry P.[1]	*Harvard Medical School, Boston, Mass.*	1887
Branner, John C	*Stanford University, California.*	1905
Brush, George J	*14 Trumbull St., New Haven, Conn.*	1868
Campbell, D. H	*Stanford University, California.*	1910
Campbell, William W	*Lick Observatory, Mount Hamilton, California.*	1902
Cattell, James McK	*Garrison, N. Y.*	1901
Chamberlin, Thomas C	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F	*Columbia University, New York City.*	1874
Chandler, Seth C	*Box 216, Wellesley Hills, Mass.*	1888
Chittenden, Russell H	*Sheffield Scientific School, New Haven, Conn.*	1890
Clark, W. B	*Johns Hopkins University, Baltimore, Md.*	1908

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[1] Mr. Bowditch died on March 13, 1911.

		Date of election.
Clarke, F. W	*U. S. Geological Survey, Washington, D. C.*	1909
Clarke, J. M	*State Hall, Albany, N. Y.*	1909
Comstock, George C	*Washburn Observatory, Madison, Wis.*	1899
Conklin, E. G	*Princeton, N. J.*	1908
Coulter, J. M	*University of Chicago, Chicago, Ill.*	1909
Councilman, Wm. T	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M	*59 Marlborough St., Boston, Mass.*	1872
Crew, Henry	*Northwestern University, Evanston, Ill.*	1909
Cross, Whitman	*U. S. Geological Survey, Washington, D. C.*	1908
Dall, William H	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S	*Yale University, New Haven, Conn.*	1884
Davidson, George	*2221 Washington St., San Francisco, Cal.*	1874
Davis, William Morris	*17 Francis Ave., Cambridge, Mass.*	1904
Dewey, John	*Columbia University, New York City.*	1910
Dutton, Clarence E., U. S. A	*Englewood, N. J.*	1884
Elkin, William L	*Yale University Observatory, New Haven, Conn.*	1895
Emmons, Samuel F.[1]	*U. S. Geological Survey, Washington, D. C.*	1892
Farlow, W. G	*Harvard University, Cambridge, Mass.*	1879
Flexner, Simon	*Rockefeller Institute, New York City.*	1908
Frost, Edwin B	*Yerkes Observatory, Williams Bay, Wis.*	1908
Gilbert, Grove K	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A	*Yale University, New Haven, Conn.*	1897
Goodale, George L	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E	*Solar Observatory office, Pasadena, Cal.*	1902
Hastings, Charles S	*Yale University, New Haven, Conn.*	1889
Hilgard, Eugene W	*University of California, Berkeley, Cal.*	1872
Hill, George W	*West Nyack, N. Y.*	1874
Hillebrand, William F	*Bureau of Standards, Washington, D. C.*	1908
Holden, Edward S	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H	*U. S. National Museum, Washington, D. C.*	1905
Howell, William H	*Johns Hopkins University, Baltimore, Md.*	1905
Iddings, Joseph P	*Brinklow, Md.*	1907
Jackson, Charles L	*6 Boylston Hall, Cambridge, Mass.*	1883
Lindgren, Waldemar	*U. S. Geological Survey, Washington, D. C.*	1909
Loeb, Jacques	*Rockefeller Institute, New York City.*	1910
Mall, Franklin P	*Johns Hopkins University, Baltimore, Md.*	1907
Mark, Edward L	*109 Irving St., Cambridge, Mass.*	1903
Mendenhall, Thomas C	*Worcester, Mass.*	1887
Merriam, C. Hart	*1919 Sixteenth St., Washington, D. C.*	1902
Michael, Arthur	*219 Parker St., Newton Center, Mass.*	1889
Michelson, Albert A	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut St., Philadelphia, Pa.*	1865
Moore, Eliakim H	*University of Chicago, Chicago, Ill.*	1901
Morgan, T. H	*Columbia University, New York City.*	1909
Morley, Edward W	*West Hartford, Conn.*	1897
Morse, Edward S	*P. O. Box 268, Salem, Mass.*	1876
Morse, Harmon N	*Johns Hopkins University, Baltimore, Md.*	1907
Moulton, F. R	*University of Chicago, Chicago, Ill.*	1910
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Nichols, Edward L	*Cornell University, Ithaca, N. Y.*	1901

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[1] Mr. Emmons died on March 28, 1911.

		Date of election.
Nichols, Ernest F.	*Dartmouth College, Hanover, N. H.*	1908
Noyes, Arthur A.	*Massachusetts Institute of Technology, Boston, Mass.*	1905
Noyes, William A.	*University of Illinois, Urbana, Ill.*	1910
Osborn, H. F.	*American Museum of Natural History, New York City.*	1900
Osborne, T. B.	*Agr. Exp. Station, New Haven, Conn.*	1910
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Benjamin O.	*Harvard University, Cambridge, Mass.*	1906
Peirce, Charles S.	*Milford, Pa.*	1876
Pickering, Edward C.	*Harvard College Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs Ave., Newport, R. I.*	1872
Pupin, Michael I.	*Columbia University, New York City.*	1905
Putnam, Frederick W.	*Peabody Museum, Cambridge, Mass.*	1885
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W.	*Harvard University, Cambridge, Mass.*	1899
Royce, Josiah	*Harvard University, Cambridge, Mass.*	1906
Sargent, Charles S.	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Schuchert, Charles	*Yale University, New Haven, Conn.*	1910
Scott, William B.	*Princeton University, Princeton, N. J.*	1906
Scudder, Samuel H.	*Cambridge, Mass.*	1877
Smith, Edgar F.	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Theobald	*Harvard Medical School, Boston, Mass.*	1908
Story, William E.	*Clark University, Worcester, Mass.*	1908
Thomson, Elihu	*Swampscott, Mass.*	1907
Trelease, Wm.	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R.	*University of Wisconsin, Madison, Wis.*	1902
Verrill, A. E.	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D.	*Smithsonian Institution, Washington, D. C.*	1896
Webster, Arthur G.	*Clark University, Worcester, Mass.*	1903
Welch, William H.	*807 St. Paul St., Baltimore, Md.*	1895
Wells, Horace L.	*Yale University, New Haven, Conn.*	1903
Wheeler, Henry L.	*Sheffield Scientific School, New Haven, Conn.*	1909
Wilson, Edmund B.	*Columbia University, New York City.*	1899
Wood, Horatio C.	*4107 Chester Ave., Philadelphia, Pa.*	1879
Woodward, Robert S.	*Carnegie Institution, Washington, D. C.*	1896
Wright, Arthur W.	*Yale University, New Haven, Conn.*	1881

HONORARY MEMBER.

Smith, Sidney I.	*Yale University, New Haven, Conn.*	1884

FOREIGN ASSOCIATES.

Arrhenius, S. A.	*Nobelinstitut, Stockholm.*	1908
Auwers, Arthur	*Königl. Akad. der Wissenschaften, Berlin.*	1883
Backlund, Oskar	*Astron. Sternwarte, Pulkowa.*	1903
Baeyer, Adolph Ritter von	*Universität, Munich.*	1898
Barrois, Charles	*Université, Lille.*	1908
Bornet, Edouard	*Paris.*	1901
Brögger, W. C.	*Universitet, Christiania.*	1903
Darwin, Sir George Howard	*Newnham Grange, Cambridge.*	1904
Dewar, Sir James	*University, Cambridge.*	1907
Ehrlich, Paul	*Königl. Inst. für Exper. Therapie, Frankfurt a. Main.*	1904
Fischer, Emil	*Chemisches Inst. der Universität, Berlin.*	1904
Forsyth, A. R.	*Trinity College, Cambridge.*	1907
Geikie, Sir Archibald	*Haslemere, Surrey.*	1901
Gill, Sir David	*Royal Observatory, Cape Town.*	1898
Groth, Paul von	*Universität, Munich.*	1905

		Date of election.
Hilbert, David	*Universität, Göttingen.*	1907
Hooker, Sir J. D	*14 South Parade, Bath.*	1883
Kapteyn, John C	*Rijks Universiteit, Groningen.*	1907
Klein, Felix	*Universität, Göttingen.*	1898
Kronecker, Hugo	*Kantonale Universität, Berne.*	1901
Lankester, E. Ray	*South Kensington, London.*	1903
Larmor, Joseph	*St. Johns College, Cambridge.*	1908
Lister, Lord	*Regents Park, W., London.*	1898
Lorentz, Hendrik Anton	*Rijks Universiteit, Leiden.*	1906
Ostwald, Wilhelm	*Grossbothen, bei Leipzig.*	1906
Pavlov, Ivan P	*Kais Inst. für Exper. Med., St. Petersburg.*	1908
Penck, Albrecht	*Universität, Berlin.*	1909
Pfeffer, Wilhelm	*Bot. Inst. der Universität, Leipzig.*	1903
Picard, Emile	*Université, Paris.*	1903
Poincaré, Henri	*Université, Paris.*	1898
Ramsay, Sir William	*University College, London.*	1904
Rayleigh, Lord	*University, Cambridge.*	1898
Retzius, Gustav	*Universitet, Stockholm.*	1909
Rosenbusch, H	*Universität, Heidelberg.*	1904
Seeliger, Hugo Ritter von	*Universität, Munich.*	1908
Strasburger, Edouard	*Universität, Bonn.*	1898
Suess, Edouard	*Universität, Vienna.*	1898
Thomson, Joseph John	*University, Cambridge.*	1903
Vries, Hugo de	*Universiteit, Amsterdam.*	1904
Waldeyer, Wilhelm	*Universität, Berlin.*	1909
Wundt, Wilhelm	*Universität, Leipzig.*	1909
Zirkel, Ferdinand	*Königsstrasse 2a, Bonn.*	1903

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Alexander [1]	1866	Mar. 27, 1910
Agassiz, Louis	(2)	Dec. 14, 1873
Alexandre, J. H	(2)	Mar. 2, 1867
Alexander, Stephen	(2)	June 25, 1883
Bache, Alexander Dallas	(2)	Feb. 14, 1867
Baird, Spencer F	1864	Aug. 19, 1887
Barker, George F [1]	1876	May 24, 1910
Barnard, F. A. P. [1]	(2)	Apr. 27, 1889
Barnard, J. G	(2)	May 14, 1882
Bartlett, W. H. C. [1]	(2)	Feb. 11, 1893
Beecher, Charles Emerson	1899	Feb. 14, 1904
Brewer, William H. [1]	1880	Nov. 2, 1910
Brooks, William Keith	1884	Nov. 12, 1908
Brown-Sequard, Charles E	1868	Apr. 2, 1894
Casey, Thomas L	1890	Mar. 25, 1896
Caswell, Alexis	(2)	Jan. 8, 1887
Chauvenet, William	(2)	Dec. 13, 1870
Clarke, Henry James	1872	July 1, 1873
Coffin, James	1869	Jan. 6, 1873
Coffin, J. H. C. [1]	(2)	Jan. 8, 1890
Comstock, Cyrus B. [1]	1884	May 29, 1910
Cook, George H	1887	Sept. 22, 1889
Cooke, Josiah P	1872	Sept. 3, 1894

[1] Biographical notices have not been presented.

[2] Charter members, Mar. 3, 1863.

Deceased Members—Continued.

	Date of election.	Date of death.
Cope, Edward D.	1872	Apr. 12, 1897
Coues, Elliott	1877	Dec. 25, 1899
Dalton, J. C.	1864	Feb. 2, 1889
Dana, James D.[1]	(2)	Apr. 14, 1895
Davis, Charles H.	(2)	Feb. 14, 1877
Draper, Henry	1877	Nov. 20, 1882
Draper, John W.	1877	Jan. 4, 1882
Eads, James B.	1872	Mar. 8, 1887
Engelmann, George	(2)	Feb. 4, 1884
Ferrel, William	1868	Sept. 18, 1891
Frazer, John Fries	(2)	Oct. 12, 1872
Gabb, William M.	1876	May 30, 1878
Genth, F. A.	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gibbs, Wolcott	(2)	Dec. 9, 1908
Gilliss, James Melville	(2)	Feb. 9, 1865
Goode, G. Brown	1888	Sept. 6, 1896
Gould, Augustus A.	(2)	Sept. 15, 1866
Gould, Benjamin A.[1]	(2)	Nov. 27, 1896
Gray, Asa	(2)	Jan. 30, 1888
Guyot, Arnold	(2)	Feb. 8, 1884
Hadley, James	1864	Aug. 1, 1872
Haldeman, S. S.	1876	Sept. 20, 1880
Hall, Asaph	1875	Nov. 22, 1907
Hall, James[1]	(2)	Aug. 8, 1898
Hayden, F. V.	1873	Dec. 22, 1887
Henry, Joseph	(2)	May 13, 1878
Hilgard, Julius E.	(2)	May 8, 1891
Hill, Henry B.	1883	Apr. 6, 1903
Hitchcock, Edward	(2)	Feb. 27, 1864
Holbrook, J. E.	1868	Sept. 8, 1871
Hubbard, J. S.	(2)	Aug. 16, 1863
Humphreys, A. A.	(2)	Nov. 28, 1883
Hunt, T. Sterry[1]	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Johnson, S. W.[1]	1866	July 21, 1909
Keeler, J. E.	1900	Aug. 12, 1900
King, Clarence	1876	Dec. 24, 1901
Kirkland, Jared P.	1865	Dec. 10, 1877
Lane, J. Homer	1872	May 3, 1880
Langley, Samuel P.[1]	1876	Feb. 27, 1906
Le Conte, John	1878	Apr. 29, 1891
Le Conte, John L.	(2)	Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carey	1892	Mar. 15, 1897
Leidy, Joseph[1]	(2)	Apr. 30, 1891
Lesley, J. Peter[1]	(2)	June 3, 1903
Lesquereux, Leo	1864	Oct. 25, 1889
Longstreth, Miers F.[1]	(2)	Dec. 27, 1891
Loomis, Elias	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore	1872	Sept. 10, 1897
Mahan, D. H.	(2)	Sept. 16, 1871
Marsh, G. P.	1866	July 23, 1882

[1] Biographical notices have not been presented.

[2] Charter members, Mar. 3, 1863.

Deceased Members—Continued.

	Date of election.	Date of death.
Marsh, O. C.[1]	1874	Mar. 18, 1899
Mayer, Alfred M.[1]	1872	July 13, 1897
Mayo-Smith, Richmond[1]	1890	Nov. 11, 1901
Meek, F. B.	1869	Dec. 21, 1877
Meigs, M. C.	1865	Jan. 2, 1892
Mitchell, Henry[1]	1885	Dec. 1, 1902
Morgan, Lewis H	1875	Dec. 14, 1881
Morton, Henry[1]	1874	May 9, 1902
Newberry, J. S	(2)	Dec. 7, 1892
Newcomb, Simon[1]	1869	July 11, 1909
Newton, H. A	(2)	Aug. 1, 1896
Newton, John	1876	May 1, 1895
Norton, William A	1873	Sept. 21, 1883
Oliver, James E.	1872	Mar. 27, 1895
Packard, A. S.[1]	1872	Feb. 14. 1905
Penfield, Samuel L.	1900	Aug. 13, 1906
Peters, C. H. F.[1]	1876	July 18, 1890
Pourtales, L. F	1873	July 19, 1880
Powell, John W.[1]	1880	Sept. 23, 1902
Rodgers, John	(2)	May 5, 1882
Rogers, Fairman	(2)	Aug. 23, 1900
Rogers, Robert E.	(2)	Sept. 7, 1884
Rogers, Wm. A	1885	Mar. 1, 1898
Rogers, William B.	(2)	May 30, 1882
Rood, Ogden N	1885	Nov. 12, 1902
Rowland, Henry A	1881	Apr. 16, 1901
Rutherfurd, Lewis M	(2)	May 30, 1892
Saxton, Joseph	(2)	Oct. 26, 1873
Schott, Charles A.[1]	1872	July 31, 1901
Sellers, William[1]	1873	Jan. 24, 1905
Silliman, Benj., Sr.	(2)	Nov. 24, 1864
Silliman, Benj., Jr.[1]	(2)	Jan. 14, 1885
Smith, J. Lawrence	1872	Oct. 12, 1883
Stimpson, William[1]	1868	May 26, 1873
Strong, Theodore	(2)	Feb. 1, 1869
Sullivant, W. S	1873	Apr. 30, 1882
Torrey, John	(2)	Mar. 10, 1873
Totten, J. G	(2)	Apr. 22, 1864
Trowbridge, William P	1872	Aug. 12, 1892
Trumbull, James H.[1]	1872	Aug. 5, 1897
Tuckerman, Edward	1868	Mar. 15, 1886
Walker, Francis A	1878	Jan. 5, 1897
Warren, G. K	1876	Aug. 8, 1882
Watson, James C	1868	Nov. 23, 1880
Watson, Sereno	1889	Mar. 9, 1892
White, Charles A.[1]	1889	June 29, 1910
Whitman, C. O.[1]	1895	Dec. 6, 1910
Winlock, Joseph	(2)	June 11, 1875
Woodward, J. J.	1873	Aug. 17, 1884
Worthen, A. H	1872	May 6, 1888
Wyman, Jeffries	(2)	Sept. 4, 1874
Young, Charles A	1872	Jan. 3, 1908

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[1] Biographical notices have not been presented.

[2] Charter members, Mar 3, 1863.

DECEASED FOREIGN ASSOCIATES.

Adams, J. C.
Airy, Sir George B.
Argelander, F. W. A.
Baer, Karl Ernest von.
Barrande, Joachim.
Beaumont, L. Elie de.
Becquerel, Henri.
Berthelot, M. P. E.
Bertrand, J. L. F.
Boltzmann, Ludwig.
Boussingault, J. B. J. D.
Braun, Alexander.
Brewster, Sir David.
Bunsen, Robert W.
Burmeister, C. H. C.
Candolle, Alphonse de.
Cayley, Arthur.
Chasles, Michel.
Chevreul, M. E.
Clausius, Rudolph.
Cornu, Alfred.
Dove, H. W.
Dumas, J. B.
Farraday, Michael.
Gegenbaur, Karl.
Gyldén, Hugo.
Hamilton, Sir William Rowan.
Helmholtz, Baron H. von.
Hoff, J. H. van't.
Hofmann, A. W.
Huggins, Sir William.
Huxley, T. H.
Ibañez, Carlos.
Janssen, J.
Joule, James P.
Kekulé, August.
Kelvin, Lord.
Kirchoff, G. R.
Koch, Robert.
Kohlrausch, Friedrich.
Kölliker, Albert von.
Lacaze-Duthiers, Henri de.
Leuckart, Rudolph.
Lie, Sophus.
Liebig, Justus von.
Loewy, Maurice.
Ludwig, K. F. W.
Marey, E. J.
Mendeléeff, D. I.
Milne-Edwards, Henry.
Moissan, Henri.
Murchison, Sir Roderick I.
Oppolzer, Theodore von.
Owen, Sir Richard.
Pasteur, Louis.
Peters, C. A. F.
Plana, G. A. A.
Rammelsberg, C. F.
Regnault, Victor.
Reymond, Emil Du Bois.
Richthofen, F. von.
Sachs, Julius von.
Schiaparelli, Giovanni.
Stas, Jean Servais.
Stokes, Sir George G.
Struve, Otto von.
Sylvester, J. J.
Tisserand, F. F.
Virchow, Rudolph von.
Vogel, H. C.
Weierstrass, Karl.
Wöhler, Friedrich.
Würtz, Adolph.
Zittel, K. A. R. von.

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REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1911

WASHINGTON
1912

REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES

FOR

THE YEAR 1911

WASHINGTON
1912

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LETTER OF TRANSMITTAL.

National Academy of Sciences,
Office of the President,
Washington, D. C., February 1, 1912.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the year ending December 31, 1911.

Very respectfully,
Ira Remsen, *President.*

The President of the Senate.

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ACT OF INCORPORATION.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United Stats Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted*, That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and

regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AMENDMENTS.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said academy as provided in said act.

Approved, July 14, 1870.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

ANNUAL REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

MEETINGS OF THE NATIONAL ACADEMY.

During the year 1911 the academy held two stated meetings. The first was the regular annual meeting held at Washington, April 18 to 20, inclusive; the second, the autumn meeting, held at New York, November 21 to 22, inclusive.

ANNUAL MEETING.

BUSINESS SESSIONS.

The business sessions were held at the New National Museum, Washington, D. C., April 18 to 20, 1911.

Forty-four members were in attendance, as follows: Messrs. Ames, Becker, Billings, Boas, Campbell (W. W.), Cattell, Chittenden, Clark (W. B.), Clarke (F. W.), Clarke (J. M.), Conklin, Coulter, Cross, Dall, Dana, Davis, Farlow, Gill, Gooch, Hague, Hillebrand, Holmes, Howell, Iddings, Lindgren, Merriam, Minot, Morley, Morse (H. N.), Moulton, Nichols (E. L.), Noyes (A. A.), Noyes (W. A.), Osborn (H. F.), Osborne (T. B.), Peirce (B. O.), Remsen, Schuchert, Trelease, Walcott, Webster, Welch, Woodward, and Wright.

The president announced the death, since the last annual meeting, of the following members: George F. Barker, on May 24, 1910; C. B. Comstock, on May 29, 1910; Charles A. White, on June 29, 1910; William H. Brewer, on November 2, 1910; Charles O. Whitman, on December 6, 1910; Henry P. Bowditch, on March 13, 1911, and S. F. Emmons, on March 28, 1911.

REPORT OF THE HOME SECRETARY.

THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to present herewith the annual report of the home secretary of the National Academy of Sciences for the year ending April 18, 1911.

The annual report of the president of the academy for the year 1910 was transmitted to the United States Senate February 11, 1911, through the courtesy of Senator George P. Wetmore, chairman of the Joint Committee on the Library. The edition of 2,000 copies authorized by law of Congress was printed—500 copies for the use of the Senate, 1,000 copies for the use of the House of Representatives, and 500 copies for distribution by the National Academy of Sciences. The report was received from the Government Printing Office April 13, 1911. One-half of the copies received have been distributed to members of the academy, foreign associates, and those institutions and reference libraries which are on our domestic exchange list. The rest of the limited edition is distributed during the year on application of learned societies and of the members of the academy, and a small number is usually reserved for the future use of the members.

Volume X of the scientific memoirs of the academy has been completed by the printing of Memoir 7, entitled "Tables of Minor Planets Discovered by James C. Watson," by A. O. Leuschner, and prepared for publication at the expense of the Watson fund. The entire volume is now being bound, and will be sent out to all those on the exchange list of the academy.

No biographical memoirs were published during the year.

The bequest of $50,000 "for the general uses of the said academy" by Mr. Alexander Agassiz was paid over to the treasurer of the academy on February 4, 1911, by the executors of his will.

At the annual meeting in April, 1910, Messrs. D. H. Campbell, Stanford University; John Dewey, Columbia University; Jacques Loeb, Rockefeller Institute; F. R. Moulton, University of Chicago; W. A. Noyes, University of Illinois; T. B. Osborne, Agricultural Experiment Station, New Haven, Conn.; and Charles Schuchert, Yale University, were elected to membership in the academy.

Giovanni Schiaparelli, of the University of Rome, Italy, was elected a foreign associate at the same meeting.

Eight members have died since January 1, 1910: Alexander Agassiz, on March 27, 1910; George F. Barker, on May 24, 1910; Henry P. Bowditch, on March 13, 1911; William H. Brewer, on November 2, 1910; C. B. Comstock, on May 29, 1910; S. F. Emmons, on March 28, 1911; Charles A. White, on June 29, 1910; and C. O. Whitman, on December 6, 1910.

Of our foreign associates we have to record the loss of Sir William Huggins, Robert Koch, Giovanni Schiaparelli, and J. H. vant Hoff.

There are now 112 active members on the membership list, 1 honorary member, and 41 foreign associates.

Arnold Hague, *Home Secretary.*

April 18, 1911.

The president stated that on the death of Mr. Emmons on March 28, 1911, and by the authority of the constitution, he had appointed Mr. Cross to act as treasurer until the annual meeting of the academy beginning April 18, 1911.

REPORT OF THE TREASURER.

The President of the National Academy of Sciences.

Sir: I have the honor to transmit herewith the financial report of the treasurer of the National Academy of Sciences for the year ending April 18, 1911.

Income.	General fund.	Bache fund.	Watson fund.	Draper fund.	Smith fund.
Balance brought forward:					
Cash	$1,887.52	$1,522.73	$1,493.60	$628.28	$699.99
Invested income	4,000.00	4,446.64	....	760.12	830.07
Receipts:					
Interest	654.60	2,829.55	1,250.20	525.50	524.00
Members' tax	565.00	....	....	....	....
Agassiz estate	50,000.00	....	....	....	....
Reimbursed	77.00	....	....	....	....
Total	57,184.12	8,798.92	2,743.80	1,913.90	2,054.06
Disbursements	1,433.47	2,273.61	610.01	221.47	214.45
Balance:					
Cash	20,250.65	1,078.67	2,129.79	632.31	959.54
Invested income	35,500.00	5,446.64	4.00	1,060.12	880.07
Total	57,184.12	8,798.92	2,743.80	1,913.90	2,054.06

Income.	Gould fund.	Gibbs fund.	Building fund.	Comstock fund.	Marsh fund.
Balance brought forward:					
Cash	$157.51	$79.53	$31.53	$420.05	$21.18
Invested income	1,900.00	....	200.00	600.00	....
Receipts:					
Interest	1,059.17	133.66	84.58	454.79	62.50
Members' tax	....	....	....	....	....
Agassiz estate	....	....	....	....	....
Reimbursed	....	....	....	....	....
Total	3,116.68	213.19	316.11	1,474.84	83.68
Disbursements	52.43	4.35	18.42	16.71	1.50
Balance:					
Cash	1,164.25	208.84	97.69	358.13	82.18
Invested income	1,900.00	....	200.00	1,100.00	....
Total	3,116.68	213.19	316.11	1,474.84	83.68

Respectfully,

WHITMAN CROSS, *Treasurer.*

WASHINGTON, D. C., *April 18, 1911.*

The auditing committee, composed of Messrs. Gill and Dall, presented the following report:

The committee appointed to audit the accounts of the treasurer hereby certify that they have examined the statements of expenditures, receipts, and balances, and find them to correspond to the vouchers and accounts of the treasurer; also that they have examined the securities and papers contained in the box of the academy at the American Security & Trust Co.'s building, and have found them to correspond to the list furnished by the treasurer.

The reports of the auditing committee and of the treasurer were then adopted.

REPORT OF THE DIRECTORS OF THE BACHE FUND.

Since the last annual meeting the following grants have been made:

No.		
156.	May 20, 1910. Franz Boas Investigation of head forms of new-born children.	$300
157.	May 20, 1910. John A. Parkhnrst Photometric and spectroscopic survey of circumpolar stars.	500
158.	June, 1910. Louis T. More Continuation of investigation on discharge of electricity through gases; radioactivity and electromagnetic action (second appropriation; first made in May, 1908).	500
159.	Dec. 9, 1910. S. F. Acree Investigation of reactions of alkyl halides with sodium ethylate.	400
160.	Jan. 25, 1911. P. W. Bridgman Effects of high pressure; variation of freezing point of liquids with pressure; compressibility of liquids and solids; and mechanical properties of metals.	500
161.	Feb. 2, 1911. Francis B. Sumner Experiments on effects of external conditions on growing white mice.	250
162.	Apr. 17, 1911. E. W. Washhurn To prepare and measure the specific conductance of pure water.	200
163.	Apr. 17, 1911. Gilbert N. Lewis The determination of the electrode potentials of the alkali metals and of the metals of the alkaline earths.	500
164.	Apr. 17, 1911. Charles C. Adams For the expense of completing and preparing for publication a paper entitled "The geographic variations and relations of *Io*."	125
	Total	3,275

Prof. S. C. Chandler has resigned from the board, the resignation to take effect at the close of the present meeting of the academy. His successor has not yet been chosen.

SETH C. CHANDLER.
CHARLES S. MINOT.
IRA REMSEN.

REPORT OF THE TRUSTEES OF THE WATSON FUND.

The trustees of the Watson fund respectfully report progress under the appropriation of April 19, 1910, of $2,700 to be expended for the computation of tables of the minor planets discovered by Prof. James C. Watson. This work has been under the direction of Prof. Armin O. Leuschner, of the University of California. Two allotments of $190 each have been forwarded by the treasurer to Prof. Leuschner. Of this $369.25 has been expended up to April 1, 1911, as shown by vouchers in possession of the chairman of the trustees. The work has been seriously delayed by two circumstances: First, by the resignation at the beginning of computations of Mr. Champreux, one of the two computers who had been engaged, thus crippling the plan of duplicate computations until another computer could be trained. Second, on account of the serious illness of Prof. Leuschner, beginning November 29, from which he is now favorably convalescent. Meanwhile, with valuable assistance in direction of the work from Prof. Russell Tracy Crawford, some computations not requiring full duplication have been effected.

During the year tables of 12 of the Watson planets have been published by the academy in Volume X of its Memoirs. These had been completed and prepared for press under a former appropriation.

Prof. Leuschner confidently expects to resume work under the original plan, with computers in duplicate, on July 1, at the end of the present academic year.

LEWIS BOSS, *Chairman.*
W. L. ELKIN.
EDWIN B. FROST.

DRAPER FUND.

For the Draper Fund Mr. W. W. Campbell announced that the medal awarded by the academy at the last annual meeting had been prepared and would be presented to Mr. Charles Greeley Abbot during the annual subscription dinner on Wednesday evening, April 19, 1911, at the Cosmos Club.

J. LAWRENCE SMITH FUND.

TO THE NATIONAL ACADEMY OF SCIENCES:

The academy has made three grants from the J. Lawrence Smith fund, from which final reports are yet to be received.

One grant of $400 was made to assist in a research by Prof. C. C. Trowbridge, of Columbia University, on the nature of the luminous trains of meteors. He reports considerable progress.

Another of $400 was in aid of a study of certain meteorites by Dr. E. O. Hovey, of the American Museum of Natural History. He reports that he has been much delayed in this research.

The third grant of $200 was made last November in aid of a research by Dr. George P. Merrill, of the United States National Museum, as to the presence or absence of certain elements reported as occurring in small quantities in meteorites. This research is well advanced toward completion.

The unexpended income from the fund now available for grants amounts to $959.54.

Respectfully submitted.

EDWARD W. MORLEY, *Chairman.*

REPORT OF THE BOARD OF DIRECTORS OF THE GOULD FUND.

The income of this fund is by resolution of its directors devoted to the support of the Astronomical Journal, and an appropriation of $1,000 was made in November, 1909, for that purpose. A small balance of this allotment still remains. The Journal has been regularly published, 16 numbers having been issued since the publication was turned over to the Dudley Observatory, under its director. This completes volume 26. A full accounting, with vouchers, will shortly be submitted to the directors of the fund.

A grant of $50 was made in April, 1911, to Mr. Paul S. Yendell, of Dorchester, Mass., for aid in his work upon variable stars.

LEWIS BOSS, *Chairman.*
G. W. HILL.
S. C. CHANDLER.

BARNARD MEDAL.

For the Barnard Medal committee the home secretary announced that the recommendation of the academy at the last annual meeting, nominating Mr. Ernest Rutherford, of the University of Manche ter, England, as the recipient of the medal, had been favorably acted upon by the trustees of Columbia University and that the medal had been awarded.

GIBBS FUND.

For the Gibbs fund the president announced that no further report was possible than that the fund had been restored to its full amount and that an income was now available.

COMSTOCK FUND.

For the Comstock fund Mr. E. L. Nichols stated that the committee had no report to make.

PALEONTOLOGIC CORRELATION.

Mr. Osborn, chairman of the vertebrate section of the committee on paleontologic correlation, stated that an appropriation of $500 had been made for the purposes of the committee from the Bache fund, that his own work in connection with the general subject of paleontologic correlation had been the publication of The Age of Mammals, a work entirely devoted to correlation, but for which he did not desire to make any draft on the Bache fund, and that the secretary, Mr. W. D. Matthew, had been placed at some expense in correspondence with the foreign members of the committee. He reported that the only actual progress made by the committee was the publication by Dr. Louis Dollo of a paper on the correlation of the Tertiaries of Belgium.

REPORT OF COMMITTEE ON SUBDIVISION OF COMMITTEES ON BIOLOGY AND ANTHROPOLOGY.

To the Council:

The committee appointed to consider a more appropriate division of the committees on biology and anthropology submits the following report:

That the present committees on biology and anthropology be subdivided into four committees, as follows: (*a*) Botany, (*b*) zoology and animal morphology, (*c*) physiology and pathology, (*d*) anthropology and psychology.

In making these recommendations the committee consider that these academy committees are formed mainly for the purpose of obtaining opinions of experts on the merits of the candidates.

Respectfully submitted.

J. S. Billings, *Chairman.*
C. D. Walcott.
W. H. Welch.
Henry Fairfield Osborn.
Russell H. Chittenden.

The report was referred to the council, by which it was adopted, and the president announced that the council had approved the appointment of the following members as chairmen of the new committees: Mr. Trelease, of the committee on botany; Mr. Conklin, of the committee on zoology and animal morphology; Mr. Chittenden, of the committee on physiology and pathology; Mr. Holmes of the committee on anthropology and psychology.

REPORT ON INVESTMENTS.

The academy adopted the following resolution:

Resolved, That the treasurer be requested to report to the council regarding the existing investments of the funds of the academy, and to accompany this report with expert opinion as to the present value of the investments, his opinion to be based either on existing records in his possession or on new expert examination.

NEW RULES ADOPTED.

The following new rules were adopted by vote of the academy:

Rule XXI. The fiscal year of the academy shall end on December 31 of each year.

Rule XXII. The annual reports of the committees on research funds shall, so far as the academy has authority to determine their form, give a current number to each award, stating the name, position, and address of the recipient, the subject of research for which the award is made, and the sum awarded; and in later annual reports the status of the work accomplished under each award previously made shall be announced, until the research is completed, when announcement of its completion and, if published, the title and place of publication shall be stated, and the record of the award shall be reported as closed.

AMENDMENT TO RULE VIII.

The following amendment to Rule VIII of the academy was adopted by vote of the academy:

Rule VIII. The death of members shall be announced by the president on the first day of a meeting. A member shall then be selected by the president to furnish a biographical notice of the deceased at the next stated meeting. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

ACTING FOREIGN SECRETARY.

The president announced that in accordance with the authority conferred upon him by the action of the council and the academy, he had appointed Mr. H. F. Osborn as acting foreign secretary to act during the absence from the country of Mr. Hale.

FINANCE COMMITTEE.

The academy adopted the following resolution:

Resolved, That a finance committee of three members be appointed by the president, of which the treasurer shall be one, and that the duties of the finance committee shall be to approve of new investments, make recommendations to the council on the financial affairs of the academy, and to report on such matters as may be referred to the committee by the council.

COMMITTEE ON TRUST FUNDS.

Mr. Woodward, chairman of the committee on trust funds, stated that the committee appointed by the president to consider the question of the allotment of grants from the research funds of the academy and to make recommendations with respect thereto was able to make the following preliminary report:

The conclusions to which the present committee has arrived are the following:

First. That the academy should take the initiative in the organization and conduct of research. It should not wait for applications or for suggestions to come in wholly from the outside. Such suggestions should be urged, but the academy should not relegate itself to the function of a mere disbursing organization; it should seek rather to determine what projects are worthy of investigation and how the funds may be most judiciously administered.

Second. The academy should ask for and require a system of annual reports of progress from all those to whom grants have been made from the funds of the academy.

Third. There should be separate reports from each of the committees in charge of the various trust funds, but there should also be a general committee on trust funds, which should be in frequent conference with the separate committees, and this general committee should also make its annual report and recommendations to the academy.

AMENDMENTS TO THE CONSTITUTION.

The following amendments to the constitution having for their object the elimination of the indiscriminate use of the words "meetings" and "sessions" by using the term "meeting" for the larger group composed of business or scientific sessions, and adopted in committee of the whole at the autumn meeting in St. Louis, were adopted by vote of the academy.

NOTE.—Words and phrases in brackets are omitted and words in italics inserted.

CONSTITUTION OF THE NATIONAL ACADEMY.

* * * * * * *

ARTICLE I.—OF MEMBERS.

* * * * * * *

SEC. 2. Members who, from age or inability to attend the [sessions] *meetings* of the academy, wish to resign the duties of active membership may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

* * * * * * *

ARTICLE II.—OF THE OFFICERS.

SECTION 1. The officers of the academy shall be a president, a vice president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated [session] *meeting* after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the [session] *meeting* when such vacancy occurs, or at the next stated [session] *meeting* thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the academy until the next stated [session] *meeting* of the academy.

* * * * * * *

SEC. 3. The president of the academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its [session] *meeting* next ensuing; and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated [sessions] *meetings* in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each [session] *meeting* shall be duly engrossed before the next stated [session] *meeting* under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the [April session] *annual meeting*. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

* * * * * * *

SECTION 1. The academy shall hold one stated [session] *meeting* in each year, *called the annual meeting*, in the city of Washington, *beginning* on the third Tuesday in April, and another, *called the autumn meeting*, may be held at such place and time as the council shall determine.

Special [sessions] *business meetings* of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

[Scientific sessions] *Special scientific meetings* of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each [daily] *session of a* meeting shall be recorded in the minutes, and the members present at any [meeting] *session* shall constitute a quorum for the transaction of business.

SEC. 3. Scientific [meetings] *sessions* of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; [those] *sessions* for the transaction of business *shall be* closed.

SEC. 4. [The] Stated meetings of the council shall be held during the stated or special [sessions] *meetings* of the academy. Special [sessions] *meetings of* *the council* may be convened at the call of the president and two members of the council, or of four members of the council.

* * * * * * *

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

* * * * * * *

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the [first stated session] *annual meeting* in each year.

SEC. 4.[1] The academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the [subject] *branch of research* in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

SEC. 5.[1] Election [to membership shall be held as described below] *of members shall be held at the annual meeting in Washington in the following manner:* There shall be two ballots—a preference ballot, which may be prepared either before or at the *annual* meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

[1.] *Preference ballot.*[2]—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

[2.] *Final ballot.*[2]—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 20 votes in all, provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

[Election of members shall be held at the regular stated session of each year held in Washington, and] Not more than 10 members shall be elected at [that session] *one annual meeting.*

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[1] The paragraph formerly appearing at the head of section 5 has been placed as the ragraph under section 4, without further change.

ide headings have always been in constitution.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated [session] *meeting* after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council and may be elected at the [regular stated session of each year, held in Washington,] *annual meeting* by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.

Recommendations for nomination of foreign associates may be sent to the home secretary at any time.

* * * * * * *

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SEC. 1. Communications on scientific subjects shall be read at scientific [meetings] *sessions* of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the [president, with the advice of the] council *or of the committee of arrangements.*

* * * * * * *

SEC. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated [session] *meeting.*

* * * * * * *

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated [sessions] *meetings.*

* * * * * * *

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated [session] *meeting* of the academy. Notice of a proposition for such a change must be given at a stated [session] *meeting*, and shall be referred to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated [session] *meeting*, and if it receives two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

ELECTION OF TREASURER.

Mr. Whitman Cross was elected treasurer of the academy, to serve for the term of six years ending with the annual meeting in 1917.

ELECTION OF MEMBERS OF THE COUNCIL.

Messrs. E. G. Conklin and A. A. Noyes were elected members of the council for the term of three years ending with the annual meeting in 1914.

ELECTION OF NEW MEMBERS.

The following men were elected to membership in the academy: E. E. Barnard, of Yerkes Observatory; B. B. Boltwood, of Yale University; Arthur L. Day, of the Geophysical Laboratory at Washington, D. C.; Edwin H. Hall, of Harvard University; R. A. Harper, of the University of Wisconsin; John F. Hayford, of Northwestern University; James F. Kemp, of Columbia University; J. O. Stieglitz, of the University of Chicago; and E. B. Van Vleck, of the University of Wisconsin.

ELECTION OF FOREIGN ASSOCIATES.

The following men were elected foreign associates of the academy: Ernest Rutherford, of the University of Manchester, England, and Vito Volterra, of the University of Rome, Italy.

SCIENTIFIC SESSIONS.

The scientific sessions were held in the United States National Museum, Washington, D. C., April 18 to 20, 1911.

APRIL 18.

On the motions of the brighter helium stars. W. W. Campbell.

Report of progress in spectrographic determinations of stellar motions. W. W. Campbell.

The evolution of periodic solutions of the problem of three bodies. F. R. Moulton.

Mechanical quadratures. G. F. Becker.

Corollaries of the theory of isostasy. W. M. Davis.

On the origin of the peaks of maximum pressure in the midst of the permanent tropical oceanic highs. W. J. Humphreys (introduced by Cleveland Abbe).

APRIL 19.

The outlook of petrology. J. P. Iddings.

The orogenic development of the northern Sierra Nevada. Waldemar Lindgren.

Biological conclusions drawn from the evolution of the Titanotheres. H. F. Osborn.

A geological reconnoissance in the Rocky Mountains of British Columbia. Chas. D. Walcott.

Comparative study of the early stages of vertebrates. C. S. Minot.

APRIL 20.

Restorations and ontogeny of the Eurypterids. J. M. Clarke.

Infantile paralysis and its mode of transmission. Simon Flexner (read by C. S. Minot).

Studies of the pulmonary circulation. Horatio Wood, jr. (introduced by H. C. Wood).

Aristotle's History of Animals. Theo. Gill.

Changes in bodily form of descendants of immigrants. Franz Boas.

Classification of Shoshonean tribes. C. Hart Merriam.

The outside and the inside of the Yosemite Indian. C. Hart Merriam.

READ BY TITLE.

Experimental investigation on reflection of light at certain metal-liquid surfaces. Lynde P. Wheeler (introduced by C. S. Hastings).

A further study of columbic and tantalic oxides. E. F. Smith.

A new reptile from the Newark beds. W. B. Scott.

Cell size and nuclear size. E. G. Conklin.

The cause of death of the unfertilized egg and the cause of the life-saving action of fertilization. Jacques Loeb.

An American Lepidostrobus. J. M. Coulter.

Notes on New England Mollusca. E. S. Morse.

Biographical memoir of W. H. C. Bartlett. E. S. Holden.

Biographical memoir of C. B. Comstock. H. L. Abbot.

Biographical memoir of S. W. Johnson. T. B. Osborne.

Biographical memoir of Benjamin Silliman, 1816–1885. A. W. Wright.

Biographical memoir of James H. Trumbull. A. W. Wright.

Biographical memoir of C. A. White. Wm. H. Dall.

Biographical memoir of Joseph Leidy. Henry Fairfield Osborn.

AUTUMN MEETING.

The autumn meeting was held at New York, November 21 and 22, 1911.

Fifty-six members were in attendance, as follows: Becker, Billings, Boltwood, Boss, Cattell, Chandler (C. F.), Chittenden, Clark (W. B.), Clarke (F. W.), Clarke (J. M.), Conklin, Councilman, Cross, Dana, Dewey, Elkins, Farlow, Flexner, Gill, Hague, Harper, Hastings, Holmes, Iddings, Kemp, Lindgren, Loeb, Mall, Mark, Minot, Mitchell, Morgan, Morley, Morse (E. S.), Nichols (E. L.), Noyes (A. A.), Osborn (H. F.), Osborne (T. B.), Pickering, Prudden, Pumpelly, Pupin, Remsen, Schuchert, Scott, Story, Thomson, Trelease, Verrill, Walcott, Welch, Wells, Wilson, Wright.

BUSINESS SESSIONS.

The business sessions were held in the New York Public Library, November 21 and 22, 1911.

AGASSIZ MEDAL.

The president announced the receipt by the academy of a trust fund of $6,000, offered by Sir John Murray for the purpose of founding an Alexander Agassiz gold medal, which shall be awarded to scientific men in any part of the world for original contributions to the science of oceanography, and stated that he had appointed Messrs. Holmes, Hague, and Remsen as a committee on the medal in question. The academy moved a vote of thanks to Sir John Murray for his action, approved the action of the president in appointing the committee, and adopted a resolution giving the committee power to act.

SEMICENTENNIAL ANNIVERSARY.

The president announced that by the authority of the academy he had appointed the following committee on the preparation of the semicentennial anniversary volume: Messrs. Hague (chairman), Walcott, Trelease, Councilman, and Chittenden.

The president announced that by the authority of the academy he had appointed the following committee on the celebration of the semicentennial anniversary of the academy: Messrs. Conklin (chairman), W. B. Clark, and Day. The committee was instructed by vote of the academy to follow the general suggestions contained in the report of the committee on the semicentennial volume issued under date of April 18, 1908.

CONSTITUTIONAL AMENDMENT ON INVESTMENTS.

The following constitutional amendment was recommended by the council and adopted in committee of the whole for presentation to the next annual meeting, in 1912:

> All investments shall be made by the treasurer in the corporate name of the academy with the approval of a finance committee of three members, to be appointed annually by the president, of which the treasurer shall be one. Investments shall be made in bonds of the United States, in State bonds, or bonds or notes secured by first mortgages on real estate, in investments legal for savings banks under the laws of Massachusetts or New York, or in other bonds recommended to the treasurer by the fiscal advisors of the academy.
>
> The council shall, at its annual meeting in each year, designate one bank or trust company in Washington D. C., and one in New York City, to act, when requested by the treasurer, as the fiscal advisors of the academy.
>
> The treasurer shall have the authority, with the approval of the finance committee, to change any investment held by him in the corporate name of the academy.

REPORT ON INVESTMENTS.

The treasurer presented the report on investments asked for by the academy at the last annual meeting. The report was adopted and placed on file.

J. LAWRENCE SMITH FUND.

On the recommendation of the chairman of the J. Lawrence Smith fund the academy voted an additional grant of $200 to Dr. George P. Merrill for the continuation of his investigations on elements reported to occur in very small quantities in meteorites.

AMENDMENT TO RULE III.

Rule 3 was amended by vote of the academy to read as follows:

III. The accounts of the treasurer shall, between January 1 and January 15 of each year, be audited by a committee of three members, to be appointed by the president at the autumn meeting of the academy. The auditing committee may employ an expert accountant to examine the books of the treasurer. This committee shall inspect and verify the bonds, securities, and other property in the custody of the treasurer and shall compare the expenditures with the vouchers therefor. The annual report of the treasurer shall be published with that of the president to Congress. The reports of the treasurer and auditing committee shall be presented to the academy at the annual meeting.

SCIENTIFIC SESSIONS.

NOVEMBER 21.

Mode of infection in infantile paralysis. Simon Flexner.

Oxidations in the cell. Jacques Loeb.

Manifest and nonmanifest life of the tissues. Alexis Carrel (introduced by Simon Flexner).

Cell size and nuclear size. E. G. Conklin.

The biological significance of the so-called hairs of the hairy frog, *Astylosternus robustus* (Blgr.). Willy Kükenthal (introduced by E. L. Mark).

Sex limited inheritance. T. H. Morgan.

Recent advances in the study of eugenics. C. B. Davenport (introduced by T. H. Morgan).

The problem of continuity or discontinuity in the origin of unit characters in heredity. Henry F. Osborn.

NOVEMBER 22 (10 A. M.).

Ancient man in South America in the light of recent researches. Aleš Hrdlička (introduced by W. H. Holmes).

Protoplasmic movement in embryonic cells. R. G. Harrison (introduced by E. B. Wilson).

The leafy mistletoes of North America. Wm. Trelease.

A comparison of the basal Paleozoic in northwestern Europe and eastern North America. A. W. Grabau (introduced by J. F. Kemp).

New data on the bed-rock channel of the Hudson River. J. F. Kemp.

The source of the Saratoga mineral springs. J. F. Kemp.

NOVEMBER 22 (2 P. M.).

Recent experiments on the effect of the absence of moisture upon the chemical dissociation of calomel and other salts. Alexander Smith (introduced by Charles F. Chandler).

Proposed international radium standard. B. B. Boltwood.

Conductors rotating in alternating magnetic field. M. I. Pupin.

The rôle of different proteins in nutrition and growth. T. B. Osborne and Lafayette B. Mendel (introduced and read by T. B. Osborne).
The remainders of certain mechanical quadratures. George F. Becker.
A color effect in isomorphous crystallization. H. L. Wells.

READ BY TITLE.

A method of computation. C. S. Peirce.
The reasons of reasoning, or grounds of inferring. C. S. Peirce.
Biographical memoir of Samuel Pierpont Langley. Charles D. Walcott.

DEATHS DURING 1911.

HENRY PICKERING BOWDITCH.

Henry Pickering Bowditch was born April 4, 1840, at Boston. He entered Harvard College, and was graduated in 1861. In November of that year he entered the Army, became a second lieutenant in the First Massachusetts Cavalry, and served throughout the war, attaining the rank of major. He received the degree of doctor of medicine from the Harvard Medical School in 1868. He then went to Europe and studied in Paris, Bonn, and Leipzig. At the latter place he worked under Carl Ludwig. He remained abroad until 1871, and on his return was made professor of physiology at the Harvard Medical School. In 1906 he resigned his position owing to failing health and was made professor emeritus. He died March 13, 1911.

The Harvard Physiological Laboratory was the first modern laboratory for instruction and research in the medical sciences to be founded in America.

During 35 years Bowditch was an efficient leader in the development of the Harvard Medical School, and in the advancement of physiology and other medical sciences in the United States.

He became a member of the academy in 1887 and regularly attended the meetings.

GEORGE DAVIDSON.

George Davidson was born in Nottingham, England, on May 19, 1825, and accompanied his parents to the United States in 1832. He studied in the common schools and was graduated from the Central High School of Philadelphia in 1845. On graduating he entered the service of the United States Coast Survey, and in 1850 was ordered to California to initiate the work of the survey on the western coast, a work with which his name is indissolubly associated. Unaffected by the great disparity between their stipend and the greater pay of day laborers about them, and unswayed by opportunities for fortune that offered on all sides, during the most brilliant period of California's development Prof. Davidson and his associates steadily advanced the work of the survey, striking instances of the admirable few for whom duty and science prepare a guerdon that outshines the rewards of vulgar self-seeking and avarice. Between 1861 and 1867 he was engaged with operations connected with the military establishment of the United States during the Civil War, in surveys along the Atlantic coast, and in the first determination of the trans-Atlantic difference of longitude in which the Atlantic cable was utilized. Returning to California in 1867, between that date and 1895 (when his active connection with the United States Coast and Geodetic Survey terminated), his main field of professional labors extended from the Mexican border to Lynn Canal; but justice to the wide scope of his scientific sympathies and his indefatigable industry require specific mention of some of the more important of his additional duties and assignments. He was in charge of two expeditions for observation of the transit of Venus; served repeatedly as member of the United States Assay Commission; was a member of the United States Commission on Irrigation in California and of the Mississippi River Commission; investigated and reported on national irrigation methods in Egypt, India, and Japan; was honorary professor of geodesy and astronomy at the University of California for 40 years; served as regent of the same university for seven years; was a member of the jury for examination of instruments of precision for geodesy and astronomy at the Paris Exposition of 1878; and in 1889 was United States delegate to the International Geodetic Association. After retiring from the Coast and Geodetic Survey he was elected professor of commercial geography at the University of California, a chair through which he remained connected with the university until his death, his broad learning being felicitously supplemented by a mastery of the finest type of appeal to ingenuous and ambitious youth. The reference to his activities is not complete without mention of the list of 261 titles of papers and other publications, which includes the record of his discussion of subjects pertaining to astronomy, engineering, navigation, geodesy, geography, physiography, and Pacific coast history and exploration.

Recognition from abroad is evidenced by his membership in the English Royal Geographic Society, the bureau of longitudes and academy of sciences of the Institute of France, and his knight companionship in the Royal Order of St. Olaf of Norway. In the United States he was successively created doctor of philosophy, doctor of science, and doctor of laws by the College of Santa Clara, the University of Pennsylvania, and the University of California, and was rewarded with the Charles P. Daly medal of the American Geographical Society, while the number of his memberships in American scientific societies show how general was the appreciation of the extent and nature of his philosophical attainments.

He became a member of the academy in 1874, and died December 2, 1911.

SAMUEL FRANKLIN EMMONS.

Samuel Franklin Emmons was born at Boston, March 29, 1841. and died at his home in Washington, March 28, 1911. His great-grandfather, Samuel Franklin, for whom he was named, was a cousin of Benjamin Franklin. He was the son of Nathaniel H. Emmons, for many years a prominent Boston merchant.

In his boyhood days Mr. Emmons attended private schools in Boston; he entered Harvard College, and was graduated in the class of 1861 with the degree of A. B. The class furnished a goodly number of men who later became eminent in the world, among them Dr. Henry P. Bowditch. Both classmates became honored members of this academy and took an active interest in its welfare, and for several years served together in its council. Both friends died within a few days of each other. After graduation Mr. Emmons took up his scientific studies in Paris at the École Impériale des Mines, remaining there for two years. From Paris he entered the Bergakademie, at Freiberg, Saxony, pursuing courses in mining engineering and geology. He studied diligently under Cotta for a year and a half, and during that time examined nearly all of the more important mines in Saxony and Bohemia. Emmons always recognized the influence of Cotta upon his future career. Later he traveled through Europe, visiting many of the mining centers, and came home in 1866.

In May, 1867, he sailed from New York for California by way of the Isthmus of Panama, in company with other geologists and assistants in the Geological Exploration of the Fortieth Parallel, then recently authorized by act of Congress. In the following winter he received an official appointment as a member of the geological corps. He remained with the organization for nearly 10 years, till the completion of the Descriptive Geology, the second volume of a remarkable series of publications of the exploration. Upon the organization of the United States Geological Survey as a bureau of the Department of the Interior, Mr. Clarence King was chosen as its first director, and Mr. Emmons was selected as one of the geologists and placed in charge of the Rocky Mountain division, with headquarters in Denver. He remained with the survey till he died. Up to within a few years of his death Mr. Emmons continued in general charge of the work conducted by the survey upon ore bodies of the Far West. His work on The Geology and Mining Industry of Leadville has no superior in such investigations, and gave him at once an international reputation. His later contributions upon the geological occurrences of ore bodies have been many and of the highest order. He stood preeminent among the economic geologists of the country.

Mr. Emmons was made a fellow of the Geological Society of London as early as 1874. He joined the American Institute of Mining Engineers in 1877, took an active part in its proceedings, and was elected three times as one of its vice presidents. He was one of the founders of the Geological Society of America, and was elected its president in 1903, delivering, as retiring president, a notable address on "The geology of Government explorations." Mr. Emmons was elected a member of the academy in 1892, and from 1902 till his death served as its treasurer.

He was beloved of us all for his strength of character, dignified bearing, and simplicity of manner.

REPORT OF THE TREASURER.

April 18 to December 31, 1911.

The President, National Academy of Sciences.

Sir: In accordance with the new rule of the academy adopted on April 19, 1911, providing that the fiscal year of the academy shall end on December 31 of each year, I have the honor to submit my report as treasurer for the period April 18 to December 31, 1911. Before presenting the statistical matter it may be well to mention less formally some items of general interest.

The total income from investments during the period of this report was $7,136.52; the total expenditures, exclusive of investments, $4,943.19.

The sum of investments held by the academy on December 31, 1911, was $211,455 (price paid), on which it receives an average return of 4.94 per cent.

Changes in investment have been made as follows: Two first mortgage notes on real estate amounting to $17,000 have been paid in full; bonds have been purchased to the amount of $40,855 ($40,000 face value); and loans secured by first mortgage on real estate have been made in the sum of $7,000.

The directors of the Bache fund have authorized the increase of the capital of that fund to $56,000 by the transfer, on January 1, 1912, of $3,714 from accumulated income. An increase of the Gibbs fund to $3,000, by the transfer, on January 1, 1912, of $326.87 from accumulated income, has likewise been authorized by the directors of that fund.

The trust funds of the academy have been increased by the gift of 1,233 pounds sterling ($5,986.22) from Sir John Murray to found the Alexander Agassiz gold medal, to be conferred for investigations in oceanography.

CONDENSED STATEMENT OF RECEIPTS AND EXPENDITURES.

Cash income balance as per last report, Apr. 18, 1911	$26,962.05
Uninvested capital of various funds, Apr. 18, 1911	3,500.00
Total income from investments	7,136.52
Accrued interest on bonds purchased	297.22
Interest on bank deposits	222.23
Gift of Sir John Murray, £1,233 (Murray fund)	5,986.22
Mortgage notes paid	17,000.00
Annual dues from members	540.00
	61,644.24
Investments	47,855.00
General expense account	1,484.59
Accrued interest on bonds purchased	383.47
Warrants on trust funds	3,458.60
Cash balance in bank, Dec. 31, 1911, as follows:	
Uninvested capital of various funds	1,310.00
Cash income balance, Dec. 31, 1911	7,152.58
	61,644.24

STATEMENT OF ASSETS AND LIABILITIES, DECEMBER 31, 1911.

ASSETS.

1. Mortgage notes, secured by first mortgage on real estate	$135,000.00
2. Bonds (giving face value, rate of interest, and cost):	
Bush Terminal Buildings Co., $10,000, 5 per cent	9,850.00
Broadway Realty Co., $10,000, 5 per cent	10,355.00
Cosmos Club, $21,000, 4.5 per cent	21,000.00
Dominion Coal Co., $5,000, 5 per cent	5,000.00
Riggs Realty Co., $20,000, 5 per cent	20,650.00
Union Pacific Ry., $10,000, 4 per cent	9,600.00
3. Bank balance Dec. 31, 1911	8,462.58
	219,917.58

LIABILITIES.

	Income.	Capital.
General fund:		
Invested	$5,301.25	----------
Uninvested	1,180.58	----------
Agassiz fund:		
Invested	----------	$49,990.00
Uninvested	----------	10.00
Bache fund:		
Invested	4,696.64	51,376.00
Uninvested	1,941.08	910.00
Building fund:		
Invested	----------	7,000.00
Uninvested	418.89	----------
Comstock fund:		
Invested	1,100.00	10,000.00
Uninvested	599.56	----------
Draper fund:		
Invested	1,060.12	10,000.00
Uninvested	1,029.41	----------
Gibbs fund:		
Invested	----------	2,673.17
Uninvested	338.91	----------
Gould fund:		
Invested	2,932.50	20,000.00
Uninvested	987.59	----------
Marsh fund:		
Invested	----------	1,250.00
Uninvested	112.11	----------
Murray fund:		
Invested	----------	5,965.00
Uninvested	84.67	35.00
Smith fund:		
Invested	1,912.57	9,985.00
Uninvested	305.06	15.00
Watson fund:		
Invested	1,552.75	24,660.00
Uninvested	154.72	340.00
	25,708.41	194,209.17
		25,708.41
		219,917.58

ACCOUNT WITH INDIVIDUAL FUNDS, APRIL 18 TO DECEMBER 31, 1911.

	General fund.		Agassiz fund.		Bache fund.		Building fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balances, Apr. 18:								
Cash	$20,250.65				$1,078.67	$1,500.00	$97.69	
Invested	35,500.00				5,446.64	50,786.00		$7,000.00
Receipts:								
Interest on investments	1,406.26				2,238.57		325.00	
Accrued interest	182.71				10.00			
Bank interest	222.23							
Annual dues	540.00							
Transfer Agassiz fund				[1]$50,000.00				
Total	58,101.85			50,000.00	8,773.88	52,286.00	422.69	7,000.00
Disbursements:								
Warrants on funds					2,075.00			
General expenses	1,351.06				51.16		3.80	
Accrued interest	268.96				10.00			
Transfer Agassiz fund	[1]50,000.00							
Balances, Dec. 31:								
Cash	1,180.58			10.00	1,941.08	910.00	418.89	
Invested	5,301.25			49,990.00	4,696.64	51,376.00		7,000.00
Total	58,101.85			50,000.00	8,773.88	52,286.00	422.69	7,000.00
Changes in investment:								
Mortgage notes paid	2,500.00				2,000.00	3,500.00		
Investments made	3,801.25			18,490.00	1,250.00	4,090.00		

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[1] The Agassiz bequest of $50,000 was tranferred, on Apr. 18, from income to capital, and on Dec. 31 it was set apart as the Agassiz fund.

ACCOUNT WITH INDIVIDUAL FUNDS, ETC.—Continued.

	Comstock fund.		Draper fund.		Gibbs fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balances, Apr. 18:						
Cash	$358.13		$632.31		$208.84	
Invested	1,100.00	$10,000.00	1,060.12	$10,000.00		$2,673.17
Receipts:						
Interest on investments	250.00		406.87		133.66	
Total	1,708.13	10,000.00	2,099.30	10,000.00	342.50	2,673.17
Disbursements:						
Warrants on funds						
General expenses	8.57		9.77		3.59	
Balances, Dec. 31:						
Cash	599.56		1,029.41		338.91	
Invested	1,100.00	10,000.00	1,060.12	10,000.00		2,673.17
Total	1,708.13	10,000.00	2,099.30	10,000.00	342.50	2,673.17
Changes in investment:						
Mortgage notes paid				3,500.00		
Investments made				3,500.00		

	Gould fund.		Marsh fund.		Murray fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balances, Apr. 18:						
Cash	$1,164.25		$82.18			
Invested	1,900.00	$20,000.00		$1,250.00		
Receipts:						
Interest on investments	922.64		31.25		$100.00	
Accrued interest	9.86				50.00	
Transfer from income						$13.78
Murray gift						5,986.22
Total	3,996.75	20,000.00	113.43	1,250.00	150.00	6,000.00
Disbursements:						
Warrants on funds	47.25					
General expenses	19.55		1.32		1.55	
Accrued interest	9.86				50.00	
Transfer to capital					13.78	
Balances, Dec. 31:						
Cash	987.59		112.11		84.67	35.00
Invested	2,932.50	20,000.00		1,250.00		5,965.00
Total	3,996.75	20,000.00	113.43	1,250.00	150.00	6,000.00
Changes in investment:						
Mortgage notes paid						
Investments made	1,032.50					5,965.00

ACCOUNT WITH INDIVIDUAL FUNDS, ETC.—Continued.

	Smith fund.		Watson fund.		Total.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balances, Apr. 18:						
Cash	$954.54	$1,000.00	$2,129.79	$1,000.00	$26,962.05	$3,500.00
Invested	880.07	9,000.00	4.00	24,000.00	45,890.83	134,709.17
Receipts:						
Interest on investments	387.79		934.48		7,136.52	
Accrued interest	19.86		24.79		297.22	
Bank interest					222.23	
Annual dues					540.00	
Transfer Agassiz fund						50,000.00
Transfer Murray fund						13.78
Murray gift						5,986.22
Total	2,247.26	10,000.00	3,093.06	25,000.00	81,048.85	194,209.17
Disbursements:						
Warrants on funds			1,336.35		3,458.60	
General expenses	9.77		24.45		1,484.59	
Accrued interest	19.86		24.79		383.47	
Transfer Agassiz fund					50,000.00	
Transfer Murray fund					13.78	
Balances, Dec. 31:						
Cash	305.06	15.00	154.72	340.00	7,152.58	1,310.00
Invested	1,912.57	9,985.00	1,552.75	24,660.00	18,555.83	192,899.17
Total	2,247.26	10,000.00	3,093.06	25,000.00	81,048.85	194,209.17
Changes in investment:						
Mortgage notes paid				5,500.00	4,500.00	12,500.00
Investments made	1,032.50	985.00	1,548.75	6,160.00	8,665.00	39,190.00

Respectfully submitted.

WHITMAN CROSS, *Treasurer.*

REPORT OF THE AUDITING COMMITTEE.

We hereby certify that we have examined the securities and papers contained in the box of the academy at the American Security & Trust Co.'s building and have found them to correspond with the list furnished by the treasurer; also that we have accepted the certified statement of William L. Yaeger, public accountant, as to the balance shown by the books of the treasurer on December 31, 1911, and find it to agree with the balance shown by the report of the treasurer, by his check book, and by the American Security & Trust Co.

ARTHUR L. DAY,
FRANK W. CLARKE,
WM. H. DALL, *Chairman.*

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907; November 20, 1907; April 20, 1911.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act, approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

Sec. 1. The academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

Sec. 2. Members who, from age or inability to attend the meetings of the academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

Sec. 3. The academy may elect 50 foreign associates.

Sec. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the academy.

ARTICLE II.—OF THE OFFICERS.

Sec. 1. The officers of the academy shall be a president, a vice president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated meeting after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the meeting when such vacancy occurs, or at the next stated meeting thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the academy until the next stated meeting of the academy.

Sec. 2. The officers of the academy, together with six members to be elected by the academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the academy.

Sec. 3. The president of the academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its meeting next ensuing; and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

Sec. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated meetings in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each meeting shall be duly engrossed before the next stated meeting under the direction of the home secretary.

Sec. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members, and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the annual meeting. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

Sec. 1. The academy shall hold one stated meeting in each year, called the annual meeting, in the city of Washington, beginning on the third Tuesday in April, and another, called the autumn meeting, may be held at such place and time as the council shall determine.

Special business meetings of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Special scientific meetings of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each session of a meeting shall be recorded in the minutes, and the members present at any session shall constitute a quorum for the transaction of business.

SEC. 3. Scientific sessions of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; sessions for the transaction of business shall be closed.

SEC. 4. Stated meetings of the council shall be held during the stated or special meetings of the academy. Special meetings of the council may be convened at the call of the president and two members of the council, or of four members of the council.

SEC. 5. No member who has not paid his dues shall take part in the business of the academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

SEC. 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

SEC. 2. The time for holding an election of officers shall be fixed by the academy at least one day before the election is held.

SEC. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the annual meeting in each year.

SEC. 4. The academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the branch of research in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

SEC. 5. Election of members shall be held at the annual meeting in Washington in the following manner: There shall be two ballots—a preference ballot, which may be prepared either before or at the annual meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

Preference ballot.—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

Final ballot.—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 20 votes in all, provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

Not more than 10 members shall be elected at one annual meeting.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated meeting after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council and may be elected at the annual meeting by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.

SEC. 8. A diploma, with the corporate seal of the academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

Sec. 9. Resignations shall be addressed to the president and acted on by the academy.

Sec. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the academy with the recommendation that the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

Section 1. Communications on scientific subjects shall be read at scientific sessions of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

Sec. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the council or of the committee of arrangements.

Sec. 3. The academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

Sec. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated meeting.

Sec. 5. The advice of the academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

Sec. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated meetings.

Sec. 7. Medals and prizes may be established, and the means of bestowing them accepted by the academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SECTION 1. All investments shall be made by the treasurer, in the corporate name of the academy, in stocks of the United States, or, with the approval of the council, in State bonds or first-mortgage bonds on real estate. The treasurer shall have authority, with the approval of the council, to sell and transfer any United States bonds held by him in the corporate name of the academy.

SEC. 2. No contract shall be binding upon the academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the academy shall be fixed by the academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated meeting of the academy. Notice of a proposition for such a change must be given at a stated meeting, and shall be referred to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated meeting, and if it receives two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall, between January 1 and January 15 of each year, be audited by a committee of three members to be appointed by the president at the autumn meeting of the academy. The auditing committee may employ an expert accountant to examine the books of the treasurer. This committee shall inspect and verify the bonds, securities, and other property in the custody of the treasurer and shall compare the expenditures with the vouchers therefor. The annual report of the treasurer shall be published with that of the president to Congress. The reports of the treasurer and auditing committee shall be presented to the academy at the annual meeting.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.
5. Reports of president, secretaries, treasurer, and committees.

6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. The death of members shall be announced by the president on the first day of a meeting. A member shall then be selected by the president to furnish a biographical notice of the deceased at the next stated meeting. If such notice be not then furnished, another member may be selected by the president in place of the first, and so on until the duty is performed.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read before the academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the academy.

X. Memoirs shall date, in the records of the academy, from the date of their presentation to the academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the academy as early as practicable, and not later than the next stated session.

XII. The annual report of the academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of departments of the Government, and in each case to look to the department requesting the investigation for reimbursement to the academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XIX. All discussions as to the claims and qualifications of nominees at meetings of the academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the academy at the time of the discussion.

XX. Any rule of the academy may be amended, suspended, or repealed on the written motion of any two members, signed by them, and presented at a stated session of the academy, provided the same shall be approved by a majority of the members present.

XXI. The fiscal year of the academy shall end on December 31 of each year.

XXII. The annual reports of the committees on research funds shall, so far as the academy has authority to determine their form, give a current number to each award, stating the name, position, and address of the recipient, the subject of research for which the award is made, and the sum awarded; and in later annual reports the status of the work accomplished under each award previously made shall be announced, until the research is completed, when announcement of its completion and, if published, the title and place of publication shall be stated, and the record of the award shall be reported as closed.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1911–12.

	Expiration of term.
Remsen, Ira, *President*	April, 1913
Walcott, C. D., *Vice President*	April, 1913
Hale, George E., *Foreign Secretary*	April, 1916
Hague, Arnold, *Home Secretary*	April, 1913
Cross, Whitman, *Treasurer*	April, 1917

ADDITIONAL MEMBERS OF COUNCIL.

1909–1912.

Davis, W. M.
Woodward, R. S.

1910–1913.

Osborn, H. F.
Chittenden, R. H.

1911–1914.

Conklin, E. G.
Noyes, A. A.

COMMITTEES OF THE ACADEMY.

1. MATHEMATICS AND ASTRONOMY.

Abbe, C.
Barnard, E. E.
Bôcher, Maxime.
Bolza, Oskar.
Boss, Lewis.
Campbell, W. W.
Chandler, S. C.
Comstock, G. C., *Chairman*.
Elkin, W. L.
Frost, E. B.
Hale, G. E.
Hill, G. W.
Holden, E. S.
Moore, E. H.
Moulton, F. R.
Osgood, W. F.
Peirce, C. S.
Pickering, E. C.
Story, W. E.
Van Vleck, E. B.
Webster, A. G.
Woodward, R. S.

2. PHYSICS AND ENGINEERING.

Abbe, C.
Abbot, H. L.
Ames, J. S.
Barus, C.
Bell, A. G.
Crew, Henry.
Hall, Edwin H.
Hastings, C. S.
Hayford, J. F.
Mendenhall, T. C.
Michelson, A. A.
Morley, E. W.
Nichols, E. F.
Nichols, E. L.
Peirce, B. O.
Pickering, E. C.
Pupin, M. I.
Thomson, Elihu.
Trowbridge, J.
Webster, A. G.
Woodward, R. S., *Chairman*.
Wright, A. W.

3. CHEMISTRY.

Boltwood, B. B.
Chandler, C. F.
Chittenden, R. H.
Clarke, F. W.
Crafts, J. M.
Gooch, F. A.
Hilgard, E. W.
Hillebrand, W. F.
Jackson, C. L.
Michael, A.
Morley, E. W.
Morse, H. N.
Nef, John U.
Noyes, A. A., *Chairman*.
Noyes, W. A.
Osborne, T. B.
Remsen, Ira.
Richards, T. W.
Smith, E. F.
Stieglitz, J. O.
Wells, H. L.
Wheeler, H. L.

4. GEOLOGY AND PALEONTOLOGY.

Becker, G. F.
Branner, J. C.
Chamberlin, T. C.
Clark, W. B.
Clarke, J. M.
Cross, Whitman.
Dall, W. H.
Dana, E. S.
Davis, W. M.
Day, Arthur L.
Gilbert, G. K.
Hague, Arnold, *Chairman*.
Iddings, J. P.
Kemp, J. F.
Lindgren, Waldemar.
Osborn, H. F.
Pumpelly, R.
Schuchert, Chas.
Scott, W. B.
Van Hise, C. R.
Walcott, C. D.

5. BOTANY.

Campbell, D. H.
Coulter, J. M.
Farlow, W. G.
Goodale, G. L.
Harper, R. A.
Sargent, C. S.
Trelease, Wm., *Chairman*.

6. ZOOLOGY AND ANIMAL MORPHOLOGY.

Allen, J. A.
Conklin, E. G., *Chairman*.
Dall, W. H.
Gill, T. N.
Mall, F. P.
Mark, E. L.
Merriam, C. Hart.
Minot, C. S.
Morgan, T. H.
Morse, E. S.
Osborn, H. F.
Verrill, A. E.
Walcott, C. D.
Wilson, E. B.

7. PHYSIOLOGY AND PATHOLOGY.

Billings, J. S.
Chittenden, R. H., *Chairman*.
Councilman, W. T.
Flexner, Simon.
Howell, W. H.
Loeb, Jacques.
Mall, F. P.
Minot, C. S.
Mitchell, S. W.
Prudden, T. M.
Smith, Theobald.
Welch, W. H.
Wood, H. C.

8. ANTHROPOLOGY AND PSYCHOLOGY.

Boas, Franz.
Cattell, J. McK.
Dewey, John.
Holmes, W. H., *Chairman*.
Merriam, C. Hart.
Morse, E. S.
Peirce, C. S.
Putnam, F. W.
Royce, Josiah.

ON WEIGHTS, MEASURES, AND COINAGE.

Mendenhall, T. C., *Chairman*.
Michelson, A. A.
Webster, A. G.
Morley, E. W.
Peirce, C. S.
Woodward, R. S.

ON PUBLICATION.

The President.
The Home Secretary.
Walcott, C. D.

ON SOLAR RESEARCH.

Hale, George E., *Chairman.* Michelson, A. A. Comstock, G. C.
Campbell, W. W. Nichols, E. L.

TRUST FUNDS.

BOARD OF DIRECTION OF THE BACHE FUND.

[1870, residual estate, $47,500.]

For researches in physical and natural science.

Minot, C. S., *Chairman.* Remsen, Ira. Frost, E. B.

BOARD OF TRUSTEES OF THE WATSON FUND.

[1883, residual estate, $18,666.88.]

For the promotion of astronomical research.

Boss, Lewis, *Chairman.* Elkin, W. L. Frost, E. B.

THE HENRY DRAPER FUND.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Hale, George E., *Chairman.* Trowbridge, John. Wright, A. W.
Campbell, W. W. Michelson, A. A.

THE J. LAWRENCE SMITH FUND.

[1885, $8,000.]

For the investigation of meteoric bodies.

Morley, E. W., *Chairman.* Dana, E. S. Hague, Arnold.
Pumpelly, R. Remsen, Ira.

THE BENJAMIN APTHORP GOULD FUND.

[1897, $20,000.]

For researches in astronomy.

Boss, Lewis, *Chairman.* Chandler, S. C. Hill, G. W.

THE BARNARD MEDAL.[1]

For meritorious service to science.

Woodward, R. S., *Chairman.* Campbell, W. W. Noyes, A. A.
Nichols, E. F. Richards, T. W.

THE WOLCOTT GIBBS FUND.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman.* Remsen, Ira. Smith, Edgar F.

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[1] Every five years the committee recommends the person whom they consider most deserving of the medal, and upon the approval of the Academy the name of the nominee is forwarded to the trustees of Columbia College, who administer the Barnard Medal Fund.

THE COMSTOCK TRUST FUND.

[1907, $10,000.]

For researches in electricity, magnetism, and radiant energy.

Nichols, E. L., *Chairman.* Noyes, A. A. Thomas, Elihu.
Hale, George E. Webster, A. G.

THE MARSH TRUST FUND.

[1909, $1,250.]

For promoting original research in the natural sciences.

THE MURRAY FUND.

[1911, $6,000.]

To found the Alexander Agassiz gold medal, for original contributions to the science of oceanography.

Holmes, W. H., *Chairman.* Remsen, Ira Hague, Arnold.

JOSEPH HENRY FUND.

To assist meritorious investigators, especially in the direction of original research.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Company for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry Fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, FEB. 1, 1912.

		Date of election.
Abbe, Cleveland	*U. S. Weather Bureau, Washington, D. C.*	1879
Abbot, Henry L., U. S. A	*23 Berkeley St., Cambridge, Mass.*	1872
Allen, J. Asaph	*American Museum of Natural History, N. Y. City.*	1876
Ames, Joseph S	*Johns Hopkins University, Baltimore, Md.*	1909
Barnard, E. E	*Yerkes Observatory, Williams Bay, Wis.*	1911
Barus, Carl	*Brown University, Providence, R. I.*	1892
Becker, George F	*U. S. Geological Survey, Washington, D. C.*	1901
Bell, A. Graham	*1331 Concecticut Ave., Washington, D. C.*	1883
Billings, John S., U. S. A	*32 E. Thirty-first St., New York City.*	1883
Boas, Franz	*123 W. Eighty-second St., New York City.*	1900
Bôcher, Maxime	*Harvard University, Cambridge, Mass.*	1909
Boltwood, B. B.	*Yale University, New Haven, Conn.*	1911
Bolza, Oskar	*Marienstrasse 7, Freiburg, Germany.*	1909
Boss, Lewis	*Dudley Observatory, Albany, N. Y.*	1889
Branner, John C	*Stanford University, California.*	1905
Brush, George J.[1]	*1½ Trumbull St., New Haven, Conn.*	1868

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[1] Mr. Brush died on February 6, 1912.

		Date of election.
Campbell, D. H.	*Stanford University, California.*	1910
Campbell, William W.	*Lick Observatory, Mount Hamilton, California.*	1902
Cattell, James McK.	*Garrison, N. Y.*	1901
Chamberlin, Thomas C.	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F.	*Columbia University, New York City.*	1874
Chandler, Seth C.	*Box 216, Wellesley Hills, Mass.*	1888
Chittenden, Russell H.	*Sheffield Scientific School, New Haven, Conn.*	1890
Clark, W. B.	*Johns Hopkins University, Baltimore, Md.*	1908
Clarke, F. W.	*U. S. Geological Survey, Washington, D. C.*	1909
Clarke, J. M.	*State Hall, Albany, N. Y.*	1909
Comstock, George C.	*Washburn Observatory, Madison, Wis.*	1899
Conklin, E. G.	*Princeton, N. J.*	1908
Coulter, J. M.	*University of Chicago, Chicago, Ill.*	1909
Councilman, Wm. T.	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M.	*59 Marlborough St., Boston, Mass.*	1872
Crew, Henry	*Northwestern University, Evanston, Ill.*	1909
Cross, Whitman	*U. S. Geological Survey, Washington, D. C.*	1908
Dall, William H.	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S.	*Yale University, New Haven, Conn.*	1884
Davis, William Morris	*17 Francis Ave., Cambridge, Mass.*	1904
Day, Arthur L.	*Geophysical Laboratory, Washington, D. C.*	1911
Dewey, John	*Columbia University, New York City.*	1910
Elkin, William L.	*Yale University Observatory, New Haven, Conn.*	1895
Farlow, W. G.	*Harvard University, Cambridge, Mass.*	1879
Flexner, Simon	*Rockefeller Institute, New York City.*	1908
Frost, Edwin B.	*Yerkes Observatory, Williams Bay, Wis.*	1908
Gilbert, Grove K.	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N.	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A.	*Yale University, New Haven, Conn.*	1897
Goodale, George L.	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E.	*Solar Observatory office, Pasadena, Cal.*	1902
Hall, Edwin H.	*Harvard University, Cambridge, Mass.*	1911
Harper, R. A.	*Columbia University, New York City.*	1911
Hastings, Charles S.	*Yale University, New Haven, Conn.*	1889
Hayford, John F.	*Northwestern University, Evanston, Ill.*	1911
Hilgard, Eugene W.	*University of California, Berkeley, Cal.*	1872
Hill, George W.	*West Nyack, N. Y.*	1874
Hillebrand, William F.	*Bureau of Standards, Washington, D. C.*	1908
Holden, Edward S.	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H.	*U. S. National Museum, Washington, D. C.*	1905
Howell, William H.	*Johns Hopkins University, Baltimore, Md.*	1905
Iddings, Joseph P.	*Brinklow, Md.*	1907
Jackson, Charles L.	*6 Boylston Hall, Cambridge, Mass.*	1883
Kemp, James F.	*Columbia University, New York City.*	1911
Lindgren, Waldemar	*U. S. Geological Survey, Washington, D. C.*	1909
Loeb, Jacques	*Rockefeller Institute, New York City.*	1910
Mall, Franklin P.	*Johns Hopkins University, Baltimore, Md.*	1907
Mark, Edward L.	*109 Irving St., Cambridge, Mass.*	1903
Mendenhall, Thomas C.	*Worcester, Mass.*	1887
Merriam, C. Hart	*1919 Sixteenth St., Washington, D. C.*	1902

		Date of election.
MICHAEL, ARTHUR	*219 Parker St., Newton Center, Mass.*	1889
MICHELSON, ALBERT A	*University of Chicago, Chicago, Ill.*	1888
MINOT, CHARLES S	*Harvard Medical School, Boston, Mass.*	1897
MITCHELL, S. WEIR	*1524 Walnut St., Philadelphia, Pa.*	1865
MOORE, ELIAKIM H	*University of Chicago, Chicago, Ill.*	1901
MORGAN, T. H	*Columbia University, New York City.*	1909
MORLEY, EDWARD W	*West Hartford, Conn.*	1897
MORSE, EDWARD S	*P. O. Box 268, Salem, Mass.*	1876
MORSE, HARMON N	*Johns Hopkins University, Baltimore, Md.*	1907
MOULTON, F. R	*University of Chicago, Chicago, Ill.*	1910
NEF, JOHN ULRIC	*University of Chicago, Chicago, Ill.*	1904
NICHOLS, EDWARD L	*Cornell University, Ithaca, N. Y.*	1901
NICHOLS, ERNEST F	*Dartmouth College, Hanover, N. H.*	1908
NOYES, ARTHUR A	*Massachusetts Institute of Technology, Boston, Mass.*	1905
NOYES, WILLIAM A	*University of Illinois, Urbana, Ill.*	1910
OSBORN, H. F	*American Museum of Natural History, New York City.*	1900
OSBORNE, T. B	*Agr. Exp. Station, New Haven, Conn.*	1910
OSGOOD, WILLIAM FOGG	*Harvard University, Cambridge, Mass.*	1904
PEIRCE, BENJAMIN O	*Harvard University, Cambridge, Mass.*	1906
PEIRCE, CHARLES S	*Milford, Pa.*	1876
PICKERING, EDWARD C	*Harvard College Observatory, Cambridge, Mass.*	1873
PRUDDEN, T. MITCHELL	*Columbia University, New York City.*	1901
PUMPELLY, RAPHAEL	*Gibbs Ave., Newport, R. I.*	1872
PUPIN, MICHAEL I	*Columbia University, New York City.*	1905
PUTNAM, FREDERICK W	*Peabody Museum, Cambridge, Mass.*	1885
REMSEN, IRA	*Johns Hopkins University, Baltimore, Md.*	1882
RICHARDS, THEODORE W	*Harvard University, Cambridge, Mass.*	1899
ROYCE, JOSIAH	*Harvard University, Cambridge, Mass.*	1906
SARGENT, CHARLES S	*Arnold Arboretum, Jamaica Plains, Mass.*	1895
SCHUCHERT, CHARLES	*Yale University, New Haven, Conn.*	1910
SCOTT, WILLIAM B	*Princeton University, Princeton, N. J.*	1906
SMITH, EDGAR F	*University of Pennsylvania, Philadelphia, Pa.*	1899
SMITH, THEOBALD	*Harvard Medical School, Boston, Mass.*	1908
STIEGLITZ, J. O	*University of Chicago, Chicago, Ill.*	1911
STORY, WILLIAM E	*Clark University, Worcester, Mass.*	1908
THOMSON, ELIHU	*Swampscott, Mass.*	1907
TRELEASE, WM	*Missouri Botanical Garden, St. Louis, Mo.*	1902
TROWBRIDGE, JOHN	*Harvard University, Cambridge, Mass.*	1878
VAN HISE, C. R	*University of Wisconsin, Madison, Wis.*	1902
VAN VLECK, E. B	*University of Wisconsin, Madison, Wis.*	1911
VERRILL, A. E	*Yale University, New Haven, Conn.*	1872
WALCOTT, CHARLES D	*Smithsonian Institution, Washington, D. C.*	1896
WEBSTER, ARTHUR G	*Clark University, Worcester, Mass.*	1903
WELCH, WILLIAM H	*807 St. Paul St., Baltimore, Md.*	1895
WELLS, HORACE L	*Yale University, New Haven, Conn.*	1903
WHEELER, HENRY L	*Sheffield Scientific School, New Haven, Conn.*	1909
WILSON, EDMUND B	*Columbia University, New York City.*	1899
WOOD, HORATIO C	*4107 Chester Ave., Philadelphia, Pa.*	1879
WOODWARD, ROBERT S	*Carnegie Institution, Washington, D. C.*	1896
WRIGHT, ARTHUR W	*Yale University, New Haven, Conn.*	1881

HONORARY MEMBER.

		Date of election.
Smith, Sidney I	*Yale University, New Haven, Conn.*	1884

FOREIGN ASSOCIATES.

Arrhenius, S. A	*Nobelinstitut, Stockholm.*	1908
Auwers, G. F. J. Arthur	*Königl. Akad. der Wissenschaften, Berlin.*	1883
Backlund, Oskar	*Astron. Sternwarte, Pulkowa.*	1903
Baeyer, Adolph Ritter von	*Universität, Munich.*	1898
Barrois, Charles	*Université, Lille.*	1908
Brögger, W. C	*Universitet, Christiania.*	1903
Darwin, Sir George Howard	*Newnham Grange, Cambridge.*	1904
Dewar, Sir James	*University, Cambridge.*	1907
Ehrlich, Paul	*Königl. Inst. für Exper. Therapie, Frankfurt a. Main.*	1904
Fischer, Emil	*Chemisches Inst. der Universität, Berlin.*	1904
Forsyth, A. R	*Trinity College, Cambridge.*	1907
Geikie, Sir Archibald	*Haslemere, Surrey.*	1901
Gill, Sir David	*Royal Observatory, Cape Town.*	1898
Groth, Paul von	*Universität, Munich.*	1905
Hilbert, David	*Universität, Göttingen.*	1907
Kapteyn, John C	*Rijks Universiteit, Groningen.*	1907
Klein, Felix	*Universität, Göttingen.*	1898
Kronecker, Hugo	*Kantonale Universität, Berne.*	1901
Lankester, E. Ray	*South Kensington, London.*	1903
Larmor, Joseph	*St. Johns College, Cambridge.*	1908
Lister, Lord [1]	*Regents Park, W. London.*	1898
Lorentz, Hendrik Anton	*Rijks Universiteit, Leiden.*	1906
Ostwald, Wilhelm	*Grossbothen, bei Leipzig.*	1906
Pavlov, Ivan Petrovitch	*Kais Inst. für Exper. Med., St. Petersburg.*	1908
Penck, Albrecht	*Universität, Berlin.*	1909
Pfeffer, Wilhelm	*Bot. Inst. der Universität, Leipzig.*	1903
Picard, Charles Émile	*Université, Paris.*	1903
Poincaré, Jules Henri	*Université, Paris.*	1898
Ramsay, Sir William	*University College, London.*	1904
Rayleigh, Lord	*University, Cambridge.*	1898
Retzius, Gustav	*Högskolan, Stockholm.*	1909
Rosenbusch, H	*Universität, Heidelberg.*	1904
Rutherford, Ernest	*University, Manchester.*	1911
Seeliger Hugo Ritter von	*Universität, Munich.*	1908
Strasburger, Edouard	*Universität, Bonn.*	1898
Suess, Edouard	*Universität, Vienna.*	1898
Thomson, Joseph John	*University, Cambridge.*	1903
Volterra, Vito	*Università, Rome.*	1911
Vries, Hugo de	*Universiteit, Amsterdam.*	1904
Waldeyer, Wilhelm	*Universität, Berlin.*	1909
Wundt, Wilhelm	*Universität, Leipzig.*	1909
Zirkel, Ferdinand	*Königsstrasse 2a, Bonn.*	1903

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[1] Lord Lister died on February 11, 1912.

DECEASED MEMBERS.

	Date of election.	Date of death.
AGASSIZ, ALEXANDER [1]	1866	Mar. 27, 1910
AGASSIZ, LOUIS	([2])	Dec. 14, 1873
ALEXANDER, J. H.	([2])	Mar. 2, 1867
ALEXANDER, STEPHEN	([2])	June 25, 1883
BACHE, ALEXANDER DALLAS	([2])	Feb. 14, 1867
BAIRD, SPENCER F.	1864	Aug. 19, 1887
BARKER, GEORGE F.[1]	1876	May 24, 1910
BARNARD, F. A. P.[1]	([2])	Apr. 27, 1889
BARNARD, J. G.	([2])	May 14, 1882
BARTLETT, W. H. C.	([2])	Feb. 11, 1893
BEECHER, CHARLES EMERSON	1899	Feb. 14, 1904
BOWDITCH, HENRY P.[1]	1887	Mar. 13, 1911
BREWER, WILLIAM H.[1]	1880	Nov. 2, 1910
BROOKS, WILLIAM KEITH	1884	Nov. 12, 1908
BROWN-SEQUARD, CHARLES E.	1868	Apr. 2, 1894
CASEY, THOMAS L.	1890	Mar. 25, 1896
CASWELL, ALEXIS	([2])	Jan. 8, 1877
CHAUVENET, WILLIAM	([2])	Dec. 13, 1870
CLARKE, HENRY JAMES	1872	July 1, 1873
COFFIN, JAMES	1869	Jan. 6, 1873
COFFIN, J. H. C.[1]	([2])	Jan. 8, 1890
COMSTOCK, CYRUS B.	1884	May 29, 1910
COOK, GEORGE H.	1887	Sept. 22, 1889
COOKE, JOSIAH P.	1872	Sept. 3, 1894
COPE, EDWARD D.[1]	1872	Apr. 12, 1897
COUES, ELLIOTT	1877	Dec. 25, 1899
DALTON, J. C.	1864	Feb. 2, 1889
DANA, JAMES D.[1]	([2])	Apr. 14, 1895
DAVIDSON, GEORGE [1]	1874	Dec. 2, 1911
DAVIS, CHARLES H.	([2])	Feb. 14, 1877
DRAPER, HENRY	1877	Nov. 20, 1882
DRAPER, JOHN W.	1877	Jan. 4, 1882
DUTTON, C. E.[1]	1884	Jan. 4, 1912
EADS, JAMES B.	1872	Mar. 8, 1887
EMMONS, SAMUEL F.[1]	1892	Mar. 28, 1911
ENGELMANN, GEORGE	([2])	Feb. 4, 1884
FERREL, WILLIAM	1868	Sept. 18, 1891
FRAZER, JOHN FRIES	([2])	Oct. 12, 1872
GABB, WILLIAM M.	1876	May 30, 1878
GENTH, F. A.	1872	Feb. 2, 1893
GIBBS, JOSIAH WILLARD	1879	Apr. 28, 1903
GIBBS, WOLCOTT	([2])	Dec. 9, 1908
GILLISS, JAMES MELVILLE	([2])	Feb. 9, 1865
GOODE, G. BROWN	1888	Sept. 6, 1896
GOULD, AUGUSTUS A.	([2])	Sept. 15, 1866
GOULD, BENJAMIN A.[1]	([2])	Nov. 27, 1896
GRAY, ASA	([2])	Jan. 30, 1888
GUYOT, ARNOLD	([2])	Feb. 8, 1884
HADLEY, JAMES	1864	Aug. 1, 1872
HALDEMAN, S. S.	1876	Sept. 20, 1880
HALL, ASAPH	1875	Nov. 22, 1907
HALL, JAMES [1]	([2])	Aug. 8, 1898

[1] Biographical notices have not been presented.

[2] Charter members, Mar. 3, 1863.

	Date of election.	Date of death.
Hayden, F. V	1873	Dec. 22, 1887
Henry, Joseph	[2]	May 13, 1878
Hilgard, Julius E	[2]	May 8, 1891
Hill, Henry B	1883	Apr. 6, 1903
Hitchcock, Edward	[2]	Feb. 27, 1864
Holbrook, J. E	1868	Sept. 8, 1871
Hubbard, J. S	[2]	Aug. 16, 1863
Humphreys, A. A	[2]	Nov. 28, 1883
Hunt, T. Sterry [1]	1873	Feb. 12, 1892
Hyatt, Alpheus	1875	Jan. 16, 1902
Johnson, S. W	1866	July 21, 1909
Keeler, J. E	1900	Aug. 12, 1900
King, Clarence	1876	Dec. 24, 1901
Kirkland, Jared P	1865	Dec. 10, 1877
Lane, J. Homer	1872	May 3, 1880
Langley, Samuel P	1876	Feb. 27, 1906
Le Conte, John	1878	Apr. 29, 1891
Le Conte, John L	[2]	Nov. 15, 1883
Le Conte, Joseph	1875	July 6, 1901
Lea, Matthew Carey	1892	Mar. 15, 1897
Leidy, Joseph [1]	[2]	Apr. 30, 1891
Lesley, J. Peter [1]	[2]	June 3, 1903
Lesquereux, Leo	1864	Oct. 25, 1889
Longstreth, Miers F.[1]	[2]	Dec. 27, 1891
Loomis, Elias	1873	Aug. 16, 1889
Lovering, Joseph	1873	Jan. 18, 1892
Lyman, Theodore	1872	Sept. 10, 1897
Mahan, D. H	[2]	Sept. 16, 1871
Marsh, G. P	1866	July 23, 1882
Marsh, O. C.[1]	1874	Mar. 18, 1899
Mayer, Alfred M.[1]	1872	July 13, 1897
Mayo-Smith, Richmond [1]	1890	Nov. 11, 1901
Meek, F. B	1869	Dec. 21, 1877
Meigs, M. C	1865	Jan. 2, 1892
Mitchell, Henry [1]	1885	Dec. 1, 1902
Morgan, Lewis H	1875	Dec. 14, 1881
Morton, Henry [1]	1874	May 9, 1902
Newberry, J. S	[2]	Dec. 7, 1892
Newcomb, Simon [1]	1869	July 11, 1909
Newton, H. A	[2]	Aug. 1, 1896
Newton, John	1876	May 1, 1895
Norton, William A	1873	Sept. 21, 1883
Oliver, James E	1872	Mar. 27, 1895
Packard, A. S.[1]	1872	Feb. 14, 1905
Penfield, Samuel L	1900	Aug. 13, 1906
Peters, C. H. F.[1]	1876	July 18, 1890
Pourtales, L. F	1873	July 19, 1880
Powell, John W.[1]	1880	Sept. 23, 1902
Rodgers, John	[2]	May 5, 1882
Rogers, Fairman	[2]	Aug. 23, 1900
Rogers, Robert E	[2]	Sept. 7, 1884
Rogers, Wm. A	1885	Mar. 1, 1898
Rogers, William B	[2]	May 30, 1882

[1] Biographical notices have not been presented.

[2] Charter members, Mar. 3, 1863.

	Date of election.	Date of death.
Rood, Ogden N.	1885	Nov. 12, 1902
Rowland, Henry A.	1881	Apr. 16, 1901
Rutherfurd, Lewis M.	[2]	May 30, 1892
Saxton, Joseph	[2]	Oct. 26, 1873
Schott, Charles A.[1]	1872	July 31, 1901
Sellers, William[1]	1873	Jan. 24, 1905
Silliman, Benj., Sr.	[2]	Nov. 24, 1864
Silliman, Benj., Jr.	[2]	Jan. 14, 1885
Smith, J. Lawrence	1872	Oct. 12, 1883
Stimpson, William[1]	1868	May 26, 1873
Strong, Theodore	[2]	Feb. 1, 1869
Sullivant, W. S.	1873	Apr. 30, 1882
Torrey, John	[2]	Mar. 10, 1873
Totten, J. G.	[2]	Apr. 22, 1864
Trowbridge, William P.	1872	Aug. 12, 1892
Trumbull, James H.	1872	Aug. 5, 1897
Tuckerman, Edward	1868	Mar. 15, 1886
Walker, Francis A.	1878	Jan. 5, 1897
Warren, G. K.	1876	Aug. 8, 1882
Watson, James C.	1868	Nov. 23, 1880
Watson, Sereno	1889	Mar. 9, 1892
White, Charles A.	1889	June 29, 1910
Whitman, C. O.[1]	1895	Dec. 6, 1910
Winlock, Joseph	[2]	June 11, 1875
Woodward, J. J.	1873	Aug. 17, 1884
Worthen, A. H.	1872	May 6, 1888
Wyman, Jeffries	[2]	Sept. 4, 1874
Young, Charles A.	1872	Jan. 3, 1908

[1] Biographical notices have not been presented.

[2] Charter members, Mar. 3, 1863.

DECEASED FOREIGN ASSOCIATES.

Adams, J. C.
Airy, Sir George B.
Argelander, F. W. A.
Baer, Karl Ernest von.
Barrande, Joachim.
Beaumont, L. Elie de.
Becquerel, Henri.
Berthelot, M. P. E.
Bertrand, J. L. F.
Boltzmann, Ludwig.
Bornet, Edouard.
Boussingault, J. B. J. D.
Braun, Alexander.
Brewster, Sir David.
Bunsen, Robert W.
Burmeister, C. H. C.
Candolle, Alphonse de.
Cayley, Arthur.
Chasles, Michel.
Chevreul, M. E.
Clausius, Rudolph.
Cornu, Alfred.
Dove, H. W.
Dumas, J. B.
Farraday, Michael.
Gegenbaur, Karl.
Gyldén, Hugo.
Hamilton, Sir William Rowan.
Helmholtz, Baron H. von.
Hoff, J. H. van't.
Hofmann, A. W.
Hooker, Sir Joseph D.
Huggins, Sir William.
Huxley, T. H.
Ibañez, Carlos.
Janssen, J.
Joule, James P.
Kekulé, August.

Kelvin, Lord.
Kirchoff, G. R.
Koch, Robert.
Kohlrausch, Friedrich.
Kölliker, Albert von.
Lacaze-Duthiers, Henri de.
Leuckart, Rudolph.
Lie, Sophus.
Liebig, Justus von.
Loewy, Maurice.
Ludwig, K. F. W.
Marey, E. J.
Mendeléeff, D. I.
Milne-Edwards, Henry.
Moissan, Henri.
Murchison, Sir Roderick I.
Oppolzer, Theodore von.
Owen, Sir Richard.
Pasteur, Louis.
Peters, C. A. F.
Plana, G. A. A.
Rammelsberg, C. F.
Regnault, Victor.
Reymond, Emil Du Bois.
Richthofen, F. von.
Sachs, Julius von.
Schiaparelli, Giovanni.
Stas, Jean Servais.
Stokes, Sir George G.
Struve, Otto von.
Sylvester, J. J.
Tisserand, F. F.
Virchow, Rudolph von.
Vogel, H. C.
Weierstrass, Karl.
Wöhler, Friedrich.
Würtz, Adolph.
Zittel, K. A. R. von.

REPORT OF THE

NATIONAL ACADEMY OF SCIENCES

FOR THE YEAR

1912

WASHINGTON
1913

REPORT OF THE

NATIONAL ACADEMY OF SCIENCES

FOR THE YEAR

1912

WASHINGTON
1913

UNITED STATES OF AMERICA
GOVERNMENT PRINTING OFFICE

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LETTER OF TRANSMITTAL.

National Academy of Sciences,
Office of the President,
Washington, D. C., January 27, 1913.

Sir: In conformity with the requirements of the act of incorporation, approved March 3, 1863, I have the honor to submit herewith a report of the operations of the National Academy of Sciences for the year ending December 31, 1912.

Very respectfully,

Ira Remsen, *President.*

The President of the Senate.

ACT OF INCORPORATION.

AN ACT To incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. A. P. Barnard, at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden, Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren, United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Engelmann, Saint Louis, Mo.; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Gilliss, United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted,* That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted*, That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any Department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

Approved, March 3, 1863.

AMENDMENTS.

AN ACT To amend the act to incorporate the National Academy of Sciences.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences, approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said academy as provided in said act.

Approved, July 14, 1870.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements, be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said academy in aid of scientific investigations and according to the will of the donors.

Approved, June 20, 1884.

ANNUAL REPORT

OF THE

NATIONAL ACADEMY OF SCIENCES.

MEETINGS OF THE NATIONAL ACADEMY.

During the year 1912 the academy held two stated meetings. The first was the regular annual meeting held at Washington, April 16 to 18, inclusive; the second, the autumn meeting, held at Yale University, New Haven, November 12 to 13, inclusive.

ANNUAL MEETING.

BUSINESS SESSIONS.

The business sessions were held at the New National Museum, Washington, D. C., April 16 to 18, 1912.

Forty-four members were in attendance, as follows: Messrs Ames, Becker, Billings, Boltwood, Boss, Campbell (W. W.), Cattell, Chittenden, Clark (W. B.), Clarke (F. W.), Conklin, Councilman, Cross, Dall, Day, Gill, Hague, Hale, Hall, Harper, Hillebrand, Holmes, Howell, Iddings, Mall, Merriam, Minot, Mitchell, Morley, Morse (E. S.), Morse (H. N.), Moulton, Noyes (A. A.), Osborne (T. B.), Peirce (B. O.), Pickering, Pupin, Remsen, Schuchert, Trelease, Van Hise, Walcott, Webster, Woodward.

The President announced the death, since the last annual meeting, of the following members:

George Davidson, December 6, 1911.
Clarence E. Dutton, January 4, 1912.
George J. Brush, February 6, 1912.

REPORT OF THE HOME SECRETARY.

THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES.

SIR: I have the honor to present herewith the annual report of the Home Secretary of the National Academy of Sciences for the year ending April 16, 1912.

The annual report of the President of the Academy for the year 1911 was transmitted to the United States Senate February 2, 1912, through the courtesy of Senator George P. Wetmore. The edition of 2,000 copies authorized by law of Congress was printed: 500 copies for the use of the Senate, 1,000 copies for the use of the House of Representatives, and 500 copies for distribution by the National Academy of Sciences. The report was received from the Government Printing Office April 12, 1912. Copies are now being distributed to members, foreign associates, and institutions and reference libraries on our exchange list. The rest of the limited edition is distributed during the year on application of learned societies and of members of the Academy, and a small number is usually reserved for the future use of the members.

At the annual meeting in April, 1911, the following were elected to membership in the Academy: E. E. Barnard, of Yerkes Observatory; B. B. Boltwood, of Yale University; Arthur L. Day, of the Geophysical Laboratory at Washington, D. C.; Edwin H. Hall, of Harvard University; R. A. Harper, of Columbia University; John F. Hayford, of Northwestern University; James F. Kemp, of Columbia University; J. O. Stieglitz, of the University of Chicago; and E. B. Van Vleck, of the University of Wisconsin.

Messrs. Ernest Rutherford, of the University of Manchester, England, and Vito Volterra, of the University of Rome, Italy, were elected foreign associates at the same meeting.

The memoir by Mr. Trelease, entitled "A Monograph of Agave in the West Indies" and illustrated by 120 plates, has been prepared for publication and was transmitted to the Government Printing Office on April 2 for printing as the first memoir of Volume XI of the memoirs of the Academy.

The following biographical memoirs have been published during the year: Benjamin Silliman, jr., and James Hammond Trumbull, by Arthur W. Wright; William H. C. Bartlett, by Edward S. Holden; Cyrus Ballou Comstock, by Henry L. Abbot; Samuel William Johnson, by Thomas B. Osborne; Charles Abiathar White, by William H. Dall; and Samuel Pierpont Langley, by Charles D. Walcott.

On April 22, 1911, the academy received a trust fund of $6,000, offered by Sir John Murray for the purpose of founding an Alexander Agassiz gold medal, which shall be awarded to scientific men in any part of the world for original contributions to the science of oceanography. A committee appointed by the President, and consisting of Messrs. Holmes (chairman), Remsen, and Hague, has been at work on the selection of an artist for the medal in question.

In connection with the semicentennial celebration, to be held in April, 1913, two committees, appointed by the president in accordance with resolutions adopted at the last annual meeting, have been at work. The committee on the preparation of the semicentennial volume, consisting of Messrs. Walcott, Trelease, Councilman, Chittenden, and Hague (chairman), has engaged Dr. F. W. True, Assistant Secretary of the Smithsonian Institution, to take editorial charge of the volume, which is now well in hand. The committee on the celebration of the semicentennial consists of Messrs. Conklin (chairman), W. B. Clark, and Day.

Three members have died since the last annual meeting: George Davidson, on December 6, 1911; Clarence E. Dutton, on January 4, 1912; and George J. Brush, on February 6, 1912.

Of our foreign associates, we have to record the deaths of Sir Joseph Hooker and Lord Lister.

There are 116 active members on the membership list, one honorary member, and 41 foreign associates.

ARNOLD HAGUE, *Home Secretary.*

APRIL 16, 1912.

REPORT OF THE DIRECTORS OF THE BACHE FUND.

The directors authorized the treasurer of the academy to transfer $3,714 from accumulated income to the capital account on January 1, 1912, making the total capital of the fund $56,000.

Since the last annual meeting the following grants have been made:

No.

165. June 17, 1911. J. A. Parkhurst, Yerkes Observatory, Williams Bay, Wis.. $500
For the determination by photographic methods of the visual and photographic magnitudes and the spectral types of faint stars.

No.		
166.	Dec. 13, 1911. M. A. Rosanoff, Clark University, Worcester, Mass. For the determination of the several factors that influence the velocity of sugar hydrolysis.	$500
167.	S. C. Chandler, Wellesley Hills, Mass. For the definitive discussion of the latitude variation from 1725 to the present time.	350
161.	Jan. 1, 1912. F. B. Sumner Additional grant for the continuation of experiments on the effects of external conditions on growing white mice.	150
168.	Feb. 29, 1912. T. A. Mann, Concord, N. H. For the determination of the cause and mode of spread of septic sore throat.	100
169.	Apr. 6, 1912. S. F. Acree, Johns Hopkins University, Baltimore, Md. For the completion of the study of the action of alkyl halides on sodium phenolate.	500
170.	E. H. Hall, Harvard University For the study of the electromagnetic and thermomagnetic behavior of metals.	500
	Total	2,600

There are under consideration three further applications.

Since the last report Prof. Edwin B. Frost has been chosen director to fill the vacancy caused by the resignation of Prof. S. C. Chandler. Dr. Minot has been appointed chairman of the board.

Respectfully submitted.

Charles S. Minot, *Chairman*.

REPORT OF THE TRUSTEES OF THE WATSON FUND.

The work on the preparation of tables of the minor planets discovered by Watson, which has been placed under the direction of Prof. Armin O. Leuschner, has been proceeding since July 1 last, after the interruption explained in our last report.

Miss Glancy and Miss Levy have been employed as computers. Unexpected theoretical and practical difficulties have developed in relation to the preparation of general tables for abridging computations of the perturbations of the planets of the Hecuba group (½), of which the Watson planets include six. Work has been accomplished on some of the remaining four.

In compliance with the application of Prof. Leuschner, we recommend that in continuation of the work after July 1, 1912, the sum of $95 per month be granted in support of these computations upon the minor planets, so far as necessary.

Lewis Boss, *Chairman*.
William L. Elkin.
Edwin B. Frost.

The report was adopted and the recommendation was approved by vote of the academy.

DRAPER FUND.

Mr. Hale, chairman of the committee on the Draper fund, stated that in accordance with the plans for the celebration of the semicentennial anniversary of the academy it was the intention to present the Draper medal at that time, and that the committee expected to recommend the nominee at the time of the next autumn meeting.

J. LAWRENCE SMITH FUND.

To the National Academy of Sciences:

The committee on the J. Lawrence Smith fund reports in regard to researches now in progress, which have been aided by this fund, as follows:

Grant No. 1: Edmund Otis Hovey, curator in the department of geology and invertebrate paleontology in the American Museum of Natural History, New York, received in 1910 a grant of $400 to aid in the study of certain meteorites not hitherto adequately investigated. The scope of this work has been recently enlarged, owing to the acquisition by the American Museum of an important collection of meteorites, and is still in progress.

Grant No. 2: C. C. Trowbridge, professor of physics in Columbia University, New York, received in 1910 a grant of $400 in aid of his studies concerning the luminous trains of certain meteorites. He is collecting records of observations of such trains, spectroscopic and visual, largely from material existing only in manuscript, and much clerical assistance is required. The work is still in progress and the committee recommend that the sum of $250 be granted to Prof. Trowbridge annually for four years for the continuation of the work.

Grant No. 3: George P. Merrill, curator in the department of geology in the United States National Museum, received in 1910 a grant of $200 to assist in verifying the presence of certain elements reported as occurring in small quantities in some meteorites. In 1911 a further grant of $200 was voted by the academy on the recommendation of the committee. Specimens from eight meteoric falls have been examined. The examination has shown, apparently beyond question, the occurrence of platinum and vanadium among the doubtful elements, and has confirmed the reported occurrence of titanium and copper, but of no other of those regarded as doubtful. The work is still in progress.

The unexpended income from the fund now available for grants is $1,170.13.

Respectfully submitted.

Edward W. Morley, *Chairman.*

The report was adopted and the recommendation was approved by vote of the academy.

REPORT OF THE BOARD OF DIRECTORS OF THE GOULD FUND.

According to a previous report of this fund in April, 1910, and arrangements in consonance therewith, Dr. S. C. Chandler in September, 1909, turned over the publication of the Astronomical Journal, founded by Dr. B. A. Gould, to the Dudley Observatory, and the directors of the Gould fund agreed to extend its financial aid to such publication so far as its means would permit. At that time the directors granted to this object an advance payment of $1,000 from the fund.

On October 25, 1911, the directors instructed the treasurer to reserve the further amount of $2,000 subject to the order of the present editor, Lewis Boss, in support of the further publication of the journal. It has not yet been necessary to make any draft upon this latter provision.

Lewis Boss, *Chairman.*
S. C. Chandler.
George W. Hill.

GIBBS FUND.

To the National Academy of Sciences:

As chairman of the trustees of the Wolcott Gibbs fund for chemical research, I have the honor to report that the capital of the fund was raised to $3,000 on January 1, 1912, by the transfer of $326.83 from the income balance. This step was taken by the trustees at the suggestion of the finance committee of the academy. As this appropriation reduced the cash income balance to $12.08, no attempt was made to grant any portion of it this year.

Respectfully submitted.

C. L. Jackson, *Chairman.*

COMSTOCK FUND.

The president announced that he had received the resignation of Mr. Hale as a member of the committee on the Comstock fund, and that he had appointed Mr. Crew to fill the vacancy.

COMMITTEE ON PALEONTOLOGIC CORRELATION.

To the National Academy of Sciences:

I beg leave to report on what has been accomplished under my direction by the vertebrate section of the committee on paleontologic correlation, with the aid of the two appropriations of $500 each from the Bache fund.

The principal completed work in vertebrate paleontology is included in the "Age of Mammals," which I published in 1910. In addition there are three pamphlets published by the New York Academy of Sciences as follows:

Correlation Bulletin No. 1: "Plan and scope," by H. F. Osborn and W. D. Matthew, containing a sketch of plans for cooperative correlation work.

Correlation Bulletin No. 2: "Fossil vertebrates of Belgium," by Louis Dollo, containing complete lists and summaries of fossil vertebrates of the Belgian formations.

Correlation Bulletin No. 3: "Patagonia and the Pampas Cenozoic," a summary and critical review of the correlations of the Cenozoic in Argentina, by W. D. Matthew, based chiefly upon the contributions of Dr. Santiago Roth.

Dr. Matthew has prepared lists of fossil vertebrates from the North American formations, to be completed and revised by the several experts associated with the project, but thus far none are ready for publication. The Tertiary lists are very nearly complete, but require some further revision and preparation of sections to bring them down to date. The Mesozoic, Paleozoic, and Quaternary lists require extensive revision and annotation before they can be of service.

"Correlation and Palæogeography," by Prof. H. F. Osborn, to appear in the next number of the bulletin of the Geological Society of America (vol. 23, 1912), completes the subject of American correlation as it has advanced up to the present time. It sets forth the entire system which I have established with the cooperation of members of the American Museum staff, and is the final contribution which I shall make to this research.

The funds have been practically devoted to research assistance in the preparation of these reports.

It is recommended that the vertebrate section of the committee be discharged.

Henry Fairfield Osborn, *Chairman.*

The report was accepted and the recommendation approved by vote of the academy.

AGASSIZ MEDAL.

To the National Academy of Sciences:

Mr. Theodore Spicer-Simpson has made preliminary sketches for the Agassiz medal for researches in oceanography, provided for by Sir John Murray, which are satisfactory to the committee. The medal is to be 3 inches in diameter, one-eighth of an inch thick, and weighing about 9½ ounces, 24 carats fine.

Mr. Spicer-Simpson agrees to prepare the dies for this medal and furnish the first copy in gold, turning over also to the academy the dies for the same, for the sum of $1,000.

It is therefore recommended that the sum of $1,000 be allotted for this purpose, $500 to be paid to Mr. Spicer-Simpson on completion of the plaster model and $500 additional on completion of the work; provided that the expense be paid from the general income of the academy and returned to that fund from the future income receipts of the Murray fund.

W. H. Holmes, *Chairman.*
Ira Remsen.
Arnold Hague.

On the recommendation of the council the report was accepted and the recommendations approved by vote of the academy.

REPORT OF THE COMMITTEE ON COOPERATION IN SOLAR RESEARCH.

The fourth conference of the International Union for Cooperation in Solar Research was held at the Mount Wilson Solar Observatory, August 31 to September 2, 1910. The delegates present included 1 from Austria, 2 from Canada, 9 from France, 9 from Germany, 8 from Great Britain, 1 from Holland, 1 from Italy, 3 from Russia, 1 from Spain, 1 from Sweden, and 1 from Switzerland, in addition to 47 from the United States. Many of the delegates attended the meeting of the Astronomical and Astrophysical Society of America at the Harvard College Observatory and then traveled together to California. The sessions were held at the summit of Mount Wilson, where the delegates were lodged throughout the formal part of the conference. The resolutions adopted called for the continuation of the series of daily photographs of the calcium flocculi with spectroheliographs used by cooperating observatories in various parts of the world; the addition of a series of daily photographs of the hydrogen flocculi; the inclusion in the list of cooperating institutions of the observatories at Tacubaya, Mexico, and Madrid, Spain; the adoption of definite international standards of wave-lengths of the second order, based on interferometer determinations made at three laboratories; the use of barium lines in the neighborhood of λ 5800, where sharp iron lines are not sufficiently numerous for standards; the extension of the system of standards of the second order to shorter and longer wave-lengths; the measurement of standards of the third order by concave gratings at various cooperating institutions; the use of the name International Ångström (I. A.) for the unit on which the system of standards of the international system is based; the publication of the report of the sun-spot spectrum committee and of the cooperating observers in the next volume of the Transactions of the Solar Union; the continuation of visual observations of spot spectra in accordance with a revised and extended scheme; the preparation of a general catalogue of the lines in the photographic spectra of sun spots; the preparation of a new photographic map of the sun-spot spectrum on a scale of 5 mm. to the Ångström; and the general adoption of the plan of measuring position angles around the sun's limb from the north to the east.

The conference also expressed its satisfaction that the erection of a solar observatory in Japan is in contemplation, and expressed tho hope that the Secchi memorial telescope, to be erected in Italy, should consist of a tower telescope with spectroheliograph.

The most important resolution called for an extension of the activity of the Solar Union, so as to include the entire subject of astrophysics. As a first consequence of this extension, a committee was appointed to examine and report on the question of the classification of stellar spectra.

It was decided that the next meeting of the Solar Union be held at the University of Bonn in 1913.

It was generally agreed that the Solar Union has contributed in an important way to the progress of solar physics and to that close cooperation between astronomers and physicists which is essential to the rapid and effective development of astrophysical research. The interest shown in this conference by many who have taken no part in solar research, and the extension of the scope of the union so as to include all subjects of astrophysics, augur well for the future and lead to the belief that the Union will play an increasingly important part in the progress of science.

GEORGE E. HALE, *Chairman.*

SEMICENTENNIAL VOLUME.

Mr. Hague, chairman of the committee on the semicentennial volume, presented a report of progress and stated that the volume would be ready for distribution at the time of the semicentennial celebration, in April, 1913.

AMENDMENT TO THE CHARTER.

The treasurer stated that in accordance with the terms of a resolution adopted at the last autumn meeting, authorizing him to secure legal advice as to the pooling of the funds of the academy for purposes of investment, he had consulted the firm of MacVeagh, McKenney & Flannery, submitting the charter of the academy, the terms of the different deeds of gift, and a statement of what was desired by the academy, and that he had received an opinion showing the legal necessity for the following amendment to the charter of the academy.

PROPOSED AMENDMENT TO THE CHARTER OF THE NATIONAL ACADEMY OF SCIENCES.

AN ACT TO amend the act authorizing the National Academy of Sciences to receive and hold trust funds for the promotion of science and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science and for other purposes, approved June twentieth, eighteen hundred and eighty-four, be, and the same is hereby, amended to read as follows: That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, be, and the same is hereby, authorized and empowered to receive by devise, bequest, donation, or otherwise, either real or personal property, and to hold the same absolutely or in trust and to invest, reinvest, and manage the same in accordance with the provisions of its constitution, and apply said property and the income arising therefrom to the objects of its creation and according to the instructions of the donors.

On the recommendation of the council the academy adopted the following resolution:

Whereas legal opinion has shown the present charter of the academy to be unduly restrictive, not only in regard to the management of the funds intrusted to the academy, but also in the terms under which such bequests may be accepted and applied:

Resolved, That the academy take such steps as may be necessary to secure the adoption of the proposed amendment to the charter of the academy.

CONSTITUTIONAL AMENDMENT ON INVESTMENTS.

The following amendment to section 1 of Article VI of the constitution, which was adopted in committee of the whole at the autumn meeting in New York City, was adopted:

All investments shall be made by the treasurer in the corporate name of the academy with the approval of a finance committee of three members, to be appointed annually by the president, of which the treasurer shall be one. Investments shall be made in bonds of the United States, in State bonds, or bonds or notes secured by first mortgages on real estate, in investments legal for savings banks under the laws of Massachusetts or New York, or in other bonds recommended to the treasurer by the fiscal advisers of the academy.

The council shall, at its annual meeting in each year, designate one bank or trust company in Washington, D. C., and one in New York City to act, when requested by the treasurer, as the fiscal advisers of the academy.

The treasurer shall have the authority, with the approval of the finance committee, to change any investment held by him in the corporate name of the academy.

BUSINESS FROM THE COUNCIL.

The following recommendations of the council were adopted by vote of the academy:

That the medals belonging to the academy be temporarily deposited in the United States National Museum for safe-keeping.

That the treasurer be authorized to pay the annual subscription of 200 francs to the International Association of Academies.

ELECTION OF MEMBERS OF THE COUNCIL.

Messrs. W. T. Councilman and R. S. Woodward were elected members of the council for the term of three years ending with the annual meeting in 1915.

ELECTION OF NEW MEMBERS.

The following were elected to membership in the academy: John Jacob Abel, Johns Hopkins University, Baltimore, Md.; Charles Benedict Davenport, Station for Experimental Evolution, Cold Spring Harbor, N. Y.; Samuel James Meltzer, Rockefeller Institute for Medical Research, New York City; Harry Fielding Reid, Johns-Hopkins University, Baltimore, Md.; Roland Thaxter, Harvard

University, Cambridge, Mass.; William Morton Wheeler, Harvard University, Cambridge, Mass.; David White, United States Geological Survey, Washington, D. C.; and Robert Williams Wood, Johns Hopkins University, Baltimore, Md.

ELECTION OF FOREIGN ASSOCIATE.

Sir John Murray was elected a foreign associate of the academy.

DELEGATES.

The president announced the appointment of the following delegates:

George F. Becker to the meeting of the American Philosophical Society, April 18–20.
Arnold Hague to the 250th anniversary of the Royal Society of London.

President Remsen was named to represent the academy at the inauguration of President Hibben at Princeton University, May 11, 1912.

SCIENTIFIC SESSIONS.

The scientific sessions were held in the United States National Museum, Washington, D. C., April 16–18, 1912.

APRIL 16.

George E. Hale: The new tower telescope of the Mount Wilson Solar Observatory. (20 minutes.) Lantern.

W. W. Campbell:
- Radial velocities of 213 brighter Class A stars. (5 minutes.)
- Radial velocities of 190 brighter Class F stars. (5 minutes.)
- Some characteristics of stellar motions. (10 minutes.) Lantern.

W. J. Humphreys (introduced by Cleveland Abbe): Holes in the air. (15 minutes.)

R. A. Harper: The organization of the cell colony in Pediastrum. (15 minutes.) Lantern.

D. H. Campbell: On the morphology and systematic position of Calycularia radiculosa (Sande Lac), Stephens. (10 minutes.)

William Trelease: A revision of Phoradendron. (5 minutes.)

H. F. Osborn: Biological foundation of Bergson's "Creative Evolution."

E. S. Morse: Biographical memoir of C. O. Whitman. (5 minutes.)

G. L. Goodale: Biographical memoir of Alexander Agassiz. (5 minutes.)

APRIL 17.

10.30 a. m.: The following address was given by invitation of the council.

Harvey Cushing: Some observations on the functions of the pituitary body. (Illustrated by lantern slides.)

2.30 p. m.: The following addresses were given by invitation of the council:

J. A. Holmes: The national phases of the mining industry.

C. G. Abbot: The solar radiation. (Illustrated by lantern slides.)

AUTUMN MEETING.

The autumn meeting was held at Yale University, New Haven, Conn., November 12 and 13, 1912.

Forty-two members were in attendance, as follows: Messrs. Becker, Boas, Boltwood, Cattell, Chandler (C. F.), Chittenden, Clark (W. B.), Clarke (J. M.), Conklin, Councilman, Cross, Dana, Davis, Gooch, Hague, Harper, Hastings, Iddings, Kemp, Meltzer, Morley, Morse (E. S.), Nichols (E. L.), Noyes (A. A.), Osborn (H. F.), Osborne (T. B.), Peirce (B. O.), Reid, Remsen, Schuchert, Scott, Smith (Theobald), Story, Thaxter, Thomson, Verrill, Walcott, Webster, Wells, Wheeler (W. M.), Wood (R. W.), and Wright.

BUSINESS SESSIONS.

The business sessions were held in Sloane Physical Laboratory of Yale University November 12 and 13, 1912.

REPORT OF COMMITTEE ON THE HENRY DRAPER FUND.

Your committee respectfully recommends that the Henry Draper medal be awarded to M. Henri Deslandres, director of the Astrophysical Observatory at Meudon, France, for his researches in solar and stellar physics.

M. Deslandres's investigations cover a wide range of subjects, and have contributed in a most important way to the advancement of astrophysics. In 1891 he began a study of the ultra-violet spectrum of the chromosphere, in which he photographed numerous lines in the series spectrum of hydrogen and others belonging to various elements. Subsequently, with the aid of a spectrograph which was given a discontinuous motion, so as to photograph the H or K line of calcium in narrow successive sections of the solar surface, he studied these lines in the regions now known as the flocculi, distributed irregularly over the sun's disk. This method, which gives the velocities of the ascending and descending vapors through the displacements of the H and K lines, has proved of great value in a long series of observations begun at the Paris Observatory and now being continued at Meudon. The photographs also show the same lines in the spectrum of the chromosphere and prominence at the limb.

In 1893 M. Deslandres began an important series of investigations with the spectroheliograph, an instrument which has received many additions and improvements in his hands. His earlier work with low dispersion on the calcium lines was subsequently supplemented by the use of spectroheliographs of high dispersion, which made it possible to photograph the sun with different portions of the calcium and hydrogen lines and also with some of the narrower lines of other elements. In this way M. Deslandres has obtained photographs showing the structure of the solar atmosphere at different levels, permitting many valuable studies of the motion and physical nature of these vapors to be made. The most remarkable results are those obtained with the center of the $H\alpha$ line of hydrogen and with the K_3 line of calcium. These show most interesting and important phenomena in the upper solar atmosphere, including the dark "filaments" and long alignments. The latter were discovered by M. Deslandres in this way, and the "filaments," though they had previously been photographed with lower dispersion, are far better shown on these magnificent photographs.

Within the brief limits of this report it will not be possible to mention all of the researches which we owe to M. Deslandres. They include observations made at total solar eclipses; investigations on the electric and magnetic phenomena of the solar

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atmosphere; important contributions to the theories of the aurora, new stars, and nebulæ; studies of the distribution of lines in spectra and the laws of special series; observations of stellar spectra and spectra of comets; photographs of the spectra of planets for the determination of their rotation, etc. All of these investigations indicate great originality on the part of their author, who has also demonstrated his executive ability in the organization of the work of the Meudon Observatory.

Your committee is unanimous in its opinion that the Henry Draper medal should be awarded to M. Deslandres at the next annual meeting of the National Academy, and trusts that action confirming this recommendation will be taken at the autumn meeting.

Respectfully submitted.

George E. Hale, *Chairman.*

The report of the committee was adopted, and the academy voted to award the Henry Draper medal to Henri Deslandres at the annual meeting of the academy to be held in April, 1913.

DELEGATES.

The president announced that in response to invitations received by the academy he had appointed the following delegates: Mr. Welch to the International Congress on Hygiene and Demography at Washington, September 23–28, 1912; and Mr. H. F. Osborn to the dedication of the New York State Educational Building at Albany, October 15–17, 1912.

AMENDMENTS TO RULES.

Rule VIII was amended by vote of the academy to read as follows:

At each meeting the president shall announce the death of any members who may have died since the preceding meeting. As soon as practicable thereafter he shall designate a member to write, or with the approval of the president to secure from some other source, a biographical notice of each deceased member.

Rule IX (first paragraph) was amended by vote of the academy to read as follows:

The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read or presented by title before the academy.

SEMICENTENNIAL CELEBRATION.

The president announced that in accordance with the terms of a resolution adopted at the last annual meeting, authorizing him to appoint a committee with full power to carry out the provisions of the preliminary report of the committee to arrange for the celebration of the semicentennial anniversary of the academy, he has appointed a general committee consisting of Messrs. Walcott (chairman), Chittenden, Conklin, Coulter, Day, Hague, Hale, Noyes (A. A.), Osborn (H. F.), Pickering, Pupin, Thomson, Trelease, Webster, and Woodward, and that various subcommittees had been appointed.

CHAIRMAN OF THE WATSON FUND.

The academy authorized the president to appoint as temporary chairman of the committee on the Watson fund whomever the section of mathematics and astronomy should nominate for the position.

AGASSIZ MEDAL.

The following resolution was adopted:

Resolved, That the president be empowered to select a committee of three to name the recipient of the Agassiz medal.

AWARD OF MEDALS IN 1913.

The academy adopted the following resolution:

Resolved, That the council be authorized to approve the recommendations of all committees regarding the award of medals for the year 1913.

REPORT OF THE COMMITTEE ON THE COMSTOCK PRIZE.

The committee recommends:

(1) That the first award of the Comstock prize be made at the semicentennial celebration of the academy in April, 1913.

(2) That the amount of the prize be $1,500.

(3) That the prize be awarded to Prof. R. A. Millikan, of the University of Chicago, for his researches on the charge of the electron, on the exact value of the ratio of electric charge to mass, and on valency in gaseous ionization.

(4) That since there is no medal provided for in connection with this prize, the academy present to the recipient a suitably engrossed certificate of the award.

Edw. L. Nichols, *Chairman.*

The report of the committee was approved by vote of the academy, and Prof. R. A. Millikan, of the University of Chicago, was designated as the recipient of the first Comstock prize of $1,500 to be awarded at the semicentennial celebration of the academy in April, 1913.

SCIENTIFIC SESSIONS.

NOVEMBER 12.

Charles D. Walcott: Cambrian formations of Mount Robson District, British Columbia. Illustrated. 15 minutes.

William M. Davis: Physiographic evidence in favor of the subsidence theory of coral reefs. 15 minutes.

William B. Scott: Restorations of Tertiary mammals. Illustrated. 20 minutes.

Henry F. Osborn: Geologic correlation of upper paleolithic faunas of Europe and America (preliminary report).

John M. Clarke: (1) The Devonian faunas of Western Argentina; (2) Probable Devonian glacial bowlder beds in Argentina. 20 minutes.

Charles Schuchert: Climates of geologic time. Illustrated. 20 minutes.

William M. Davis: The transcontinental excursion of the American Geographical Society.

NOVEMBER 13 (10.30 a. m.)

PUBLIC SCIENTIFIC SESSION.

Jacques Loeb: On the fertilization of the egg of invertebrates with blood. 20 minutes.
Edwin G. Conklin: Cell division and differentiation. Illustrated. 15 minutes.
Charles B. Davenport: Heredity of skin color in negro-white crosses. 20 minutes.
Lafayette B. Mendel (introduced by Russell H. Chittenden): Some biochemical features of growth. Illustrated. 15 minutes.
Thomas B. Osborne: The nutritive value of the proteins of maize. 15 minutes.
Ross G. Harrison (introduced by Russell H. Chittenden): Experiments on regeneration and transplantation of limbs in the amphibia. Illustrated. 15 minutes.

NOVEMBER 13 (2.30 p. m.)

PUBLIC SCIENTIFIC SESSION.

S. J. Meltzer: Theory and fact as illustrated by an instructive experiment on the splanchnic nerve. 12 minutes.
Franz Boas: New data on the influence of heredity and environment upon the bodily form of man. 20 minutes.
Ernest W. Brown (introduced by Edward S. Dana): The problem of the asteroids. 20 minutes.
Robert W. Wood: (1) Some results obtained with the most powerful spectograph in the world. Illustrated. 20 minutes. (2) On the possibility of photographing molecules. 10 minutes. (3) On a new method of finding regularities in band spectra. Illustrated. 10 minutes.

READ BY TITLE.

Arnold Hague: Biographical memoir of Samuel Franklin Emmons.
Charles C. Adams (introduced by William H. Dall): The variations and ecological distribution of the snails of the genus Io.

DEATHS DURING 1912.

CLARENCE EDWARD DUTTON.

Clarence Edward Dutton, born at Wallingford, Conn., May 15, 1841, died at his home in Englewood, N. J., January 4, 1912. Though most widely known through his contributions to geology, he was by profession a soldier. Entering the Army as an officer in 1862, he was transferred to the regular service before the close of the Civil War, becoming an officer of ordnance. He served in that capacity until his retirement, but by detail was connected for considerable periods, first with the Powell Survey and then with the United States Geological Survey. Under the auspices of these organizations he made geologic field studies in Utah, Arizona, New Mexico, California, and the Hawaiian Islands, and published a series of important reports. He made also the principal scientific study of the Charleston earthquake, and in later years wrote a general treatise on seismology.

His work was characterized by breadth of view, and its prime motive was to discover the principles underlying phenomena. He was specially interested in the dynamics of the greater factors in terrestrial evolution, and made notable additions to the philosophy of volcanism, mountain building, continent growth, and seismology. In discussions of volcanism it was a fundamental concept that eruption is primarily conditioned by hydrostatic laws; and a cognate idea connected with the greater reliefs of the earth's surface was embodied in the word isostasy.

GEORGE JARVIS BRUSH.

George Jarvis Brush, born in Brooklyn December 15, 1831, died at his home in New Haven on February 6, 1912. Graduating from Yale in 1852, as a member of the first class to receive the degree of bachelor of philosophy from the school of applied chemistry, out of which was destined to grow the Sheffield Scientific School, with which he was so long identified as professor, executive officer, and director, Brush began his work in science as assistant to J. Lawrence Smith at the University of Virginia. At the end of the year he went to Germany, studying from 1853 to 1855 in his chosen field of chemistry and mineralogy under Liebig, von Kobell, and Pettenkofer. He also spent some time at the Mining School of Freiberg in Saxony, with a view to gaining more intimate knowledge of metallurgy, to which chair in the Yale Scientific School he was called in 1855. Feeling, however, that he was not fully equipped for this position, he spent an additional year in study at the Royal School of Mines in London, and also made a tour of inspection of the more important mines and smelting works of Great Britain and the Continent.

Early in 1857 Brush began his duties at New Haven as professor of metallurgy, but owing to his great interest in mineralogy, his chair was eventually made to include the latter science, and in 1871 was changed to mineralogy alone. Endowed with a keen vision for recognizing minerals by their external characteristics, and with a full appreciation of the importance of chemical structure and crystallographic form, reenforced by a great enthusiasm for his science, he speedily attracted to himself many vigorous workers who aided him in the discovery of new species and made more effective his efforts to increase the boundaries of the science. In 1874, aided by one of his assistants, Dr. George Hawes, he published a Manual of Determinative Mineralogy, which has been widely used. He also cooperated with Prof. James D. Dana, especially in the preparation of some of the supplements in Dana's System of Mineralogy. With the born instincts of the collector, he gathered together a large and valuable collection of minerals, which was characterized by containing many type specimens of great scientific value. Some years prior to his death, he gave this collection to the Sheffield Scientific School, with a sum of money for its maintenance and extension.

While the science of mineralogy was to Brush ever a subject of perpetual interest, yet it was in another field of work that he achieved his greatest success and accomplished that for which he will be remembered longest. Endowed with a strong and pleasing personality, with a quick and clear intellect, reenforced by a strength of will that enabled him to overcome obstacles that would daunt the ordinary mortal, he became the natural leader of the small but forceful group of men at Yale who were interested in the development of the new school of science. In those early years when the study and teaching of science had hardly justified themselves in the eyes of the American people, he worked effectively to build up a scientific school which should be worthy of the importance and dignity of science and of the university of which the school was a part. With little to encourage and much to discourage him, but supported by the substantial help of Joseph Earl Sheffield, he worked assiduously for many years, with the result that the Sheffield Scientific School became firmly established and, in large measure, as a result of his unselfish devotion. From 1857 he was chairman or executive officer until 1872, when he was appointed director of the Sheffield Scientific School, which position he held until 1898, when he retired as professor emeritus. For many years he served as treasurer of the board of trustees of the Sheffield Scientific School, and through his wise counsel and good business sense the affairs of the school were managed with great economy and skill. Rarely is found a man who combines scholarly attainments, financial skill, sure judgment, and firmness of resolution in the degree possessed by Prof. Brush. The number of his memberships in academies and societies at home and abroad testifies to the general recognition of his scientific attainments. He became a member of the National Academy in 1868 and was always greatly interested in its welfare.

LEWIS BOSS.

Lewis Boss, astronomer and fellow member of the National Academy of Sciences, passed away quietly and without pain on October 5, 1912, after failing rapidly for about a week, although he had been in poor health and gradually failing for two years or more.

He was born at Providence, R. I., on October 26, 1846. Graduating from Dartmouth College in 1870 with the degree of A. B., he joined the Government service at Washington, where, in 1872, he was appointed civilian assistant on the United States Northern Boundary Survey of the forty-ninth parallel.

It was during his connection with this survey that Dr. Boss prepared a standard catalogue of declinations, a work which immediately brought his name before the astronomers of the world.

In 1876 Dr. Boss accepted the position of director of the Dudley Observatory.

Since then his efforts have been mainly directed toward the determination of stellar positions, of stellar proper motions, and those investigations growing out of such determinations.

The crowning work of his chosen field was his undertaking of the collection, discussion, and treatment of all available observations of about 26,000 stars, for the purpose of securing as accurate proper motions of these stars as were obtainable with existing material.

The generous support of the National Academy of Sciences, and later the establishment by the Carnegie Institution of Washington of a department of meridian astrometry, for the sole purpose of supporting this work enabled Dr. Boss to advance his work rapidly.

Because of the many demands, he published the Preliminary General Catalogue of 6,188 Stars, which gives the positions and proper motions of the better determined stars on his program, in advance of the final general catalogue. The proper motions derived from the Preliminary General Catalogue afforded Dr. Boss the material for several interesting papers on the solar motion and the systematic motions of the stars.

While we all regret that he should not have been spared to see the end of his life task, it is a consolation to know that he, in part, at least, glimpsed the benefits to arise from his great project, and in fact, was a pioneer in that field of astronomy toward which our present investigations seem to lead us, the unraveling of the riddle of the stellar universe.

Dr. Boss received the honorary degree of A. M., Dartmouth, 1877; LL. D., Union, 1902; Sc. D., Syracuse, 1910; Sc. D., Dartmouth, 1912. He received the gold medal of the Royal Astronomical Society, London, in 1905; and the Lalande prize of the Paris Academy of Sciences in 1911. He was a foreign associate of the Royal Astronomical Society; member of the National Academy of Sciences, American Philosophical Society, Astronomische Gesellschaft; corresponding member of the British Association for the Advancement of Science, the Prussian Academy, and the St. Petersburg Academy.

REPORT OF THE TREASURER.

January 1 to December 31, 1912.

The President National Academy of Sciences.

Sir: I have the honor to submit my report as treasurer for the fiscal year, January 1 to December 31, 1912. Before presenting the statistical matter, it may be well to mention less formally some items of general interest.

The total income of the academy during the year, exclusive of bequests and investments paid in, was $13,340.51; the total expenditures, exclusive of investments, $7,950.25.

The sum of investments held by the academy on December 31, 1912, was $224,750.60 (price paid), on which it receives an average return of 4.94 per cent. The total income from investments during the year was $10,199.76.

Changes in investment have been made as follows: Three first-mortgage notes on real estate, amounting to $8,250, have been paid in full; one has been curtailed $1,000; the Union Pacific Railway registered 4 per cent gold bond, carried on the books at $9,600, was sold for $9,937.50, and the money reinvested in 5 per cent bonds; bonds have been purchased to the amount of $25,645.60 ($25,000 face value); and loans secured by first mortgage on real estate have been made in the sum of $6,500.

In accordance with the authorization of the directors of the fund, the capital of the Bache fund was increased to $56,000 by the transfer, on January 1, 1912, of $3,714 from accumulated income. The Gibbs fund was likewise increased to $3,000 by the transfer, on January 1, 1912, of $326.83 from accumulated income, as authorized by the directors of that fund.

The capital of the Marsh fund has been increased by the receipt of $8,000 from the executor of the estate of the late O. C. Marsh, as a second payment under his bequest of $10,000. A transfer of $127.65 from accumulated income, in accordance with a resolution adopted by the academy, has further increased the capital of the Marsh fund, so that it now amounts to $9,377.50.

The report contains a condensed statement of receipts and expenditures, a statement of assets and liabilities, and an account with each individual fund for the year 1912.

CONDENSED STATEMENT OF RECEIPTS AND EXPENDITURES.

RECEIPTS.

Cash income balance as per last report		$7, 152. 58
Uninvested capital, Jan. 1, 1912		1, 310. 00
Total income from investments during 1912		10, 199. 76
Accrued interest, account changes in investments		464. 65
Interest on bank deposits		181. 10
Marsh bequest (second payment)		8, 000. 00
Mortgage notes paid and bonds sold		22, 187. 50
Annual dues:		
1909–10	$10. 00	
1911	60. 00	
1912	585. 00	
1913	5. 00	
		660. 00
Subscriptions to semicentennial fund		1, 835. 00
		51, 990. 59

EXPENDITURES.

Investments of income		$3,567.50
Investments of capital		31,578.10
Accrued interest, account changes in investments		488.57
Warrants on trust funds:		
Bache fund—		
S. F. Acree	$500.00	
E. H. Hall	500.00	
W. C. Kendall	360.00	
Norton A. Kent	325.00	
T. A. Mann	100.00	
M. A. Rosanoff	500.00	
F. B. Sumner	150.00	
Gould fund—Astronomical Journal	500.00	
Smith fund—		
George P. Merrill	200.00	
C. C. Trowbridge	250.00	
Watson fund—		
A. O. Leuschner	1,520.00	
Mrs. A. H. Watson	200.00	
		5,105.00
General expenses:		
Bache fund, printing	2.50	
Murray fund	50.00	
Semicentennial celebration, printing	12.50	
Smith fund, editing	250.00	
General fund—		
Salary, assistant secretary and treasurer, 13 months	650.00	
Treasurer's office (auditing, bond, printing, etc.)	148.60	
Home secretary's office (clerical help, printing minutes, lists of members, circulars, etc.)	133.00	
Semicentennial volume	169.38	
Annual meeting—		
Printing	68.75	
Lunches, council dinner, etc	297.00	
Autumn meeting—		
Printing, etc	20.50	
Lunches	56.25	
Postage, express, and telegrams	90.33	
International Association of Academies dues	38.87	
Legal opinion regarding investments	250.00	
Election of members (printing, diplomas, etc.)	119.00	
		2,356.68
Cash balance in bank Dec. 31, 1912:[1]		
Cash income balance		8,472.69
Uninvested capital		422.05
		51,990.59

Unpaid dues: 1911, $10; 1912, $35; total, $45.

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[1] Four outstanding checks, $121.

STATEMENT OF ASSETS AND LIABILITIES, DEC. 31, 1912.

ASSETS.

1. Mortgage notes, secured by first mortages on real estate		$132, 250. 00
2. Bonds, giving name, face value, rate of interest, and cost:		
Broadway Realty Co., $10,000, 5 per cent	$10, 355. 00	
Bush Terminal Buildings Co., $10,000, 5 per cent	9, 850. 00	
City of Tacoma, Green River Gravity System, $4,000, 5 per cent	4, 150. 60	
Cleveland Electric Illuminating Co., $5,000, 5 per cent.	5, 100. 00	
Cosmos Club, $21,000, 4½ per cent	21, 000. 00	
Detroit Edison Co., $6,000, 5 per cent.	6, 150. 00	
Dominion Coal Co., $5,000, 5 per cent	5, 000. 00	
Georgia Railway & Electric Co., $2,000, 5 per cent	2, 060. 00	
Minneapolis General Electric Co., $2,000, 5 per cent	2, 030. 00	
Niagara Falls Power Co., $4,000, 5 per cent	4, 100. 00	
Riggs Realty Co., $22,000, 5 per cent	22, 705. 00	
		92, 500. 60
3. Bank balance, Dec. 31, 1912[1]		8, 894. 74
		233, 645. 34

LIABILITIES.

	Income.	Capital.
General fund:		
Invested	$7, 210. 00	
Uninvested	811. 08	
Agassiz fund:		
Invested		$50, 000. 00
Uninvested		
Bache fund:		
Invested	2, 575. 00	55, 985. 45
Uninvested	664. 57	14. 55
Building fund:		
Invested		7, 000. 00
Uninvested	768. 89	
Comstock fund:		
Invested	2, 000. 00	10. 250. 00
Uninvested	205. 12	87. 50
Draper fund:		
Invested	1, 535. 00	10, 000. 00
Uninvested	1, 095. 90	
Gibbs fund:		
Invested		3, 000. 00
Uninvested	162. 08	
Gould fund:		
Invested	3, 605. 00	20, 000. 00
Uninvested	893. 41	
Marsh fund:		
Invested		9, 377. 65
Uninvested	46. 96	
Murray fund:		
Invested		5, 965. 00
Uninvested	326. 05	35. 00

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[1] Four outstanding checks, $121.

	Income.	Capital.
Smith fund:		
Invested	$1,532.50	$9,985.00
Uninvested	506.58	15.00
Watson fund:		
Invested		24,730.00
Uninvested	1,169.55	270.00
Semicentennial special fund:		
Uninvested	1,822.50	
	26,930.19	206,715.15
		26,930.19
		233,645.34

ACCOUNT WITH INDIVIDUAL FUNDS, JAN. 1, 1912, TO JAN. 1, 1913.

	General fund.		Agassiz fund.		Bache fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1912:						
Cash	$1,180.58			$10.00	$1,941.08	$910.00
Invested	5,301.25			49,990.00	4,696.64	51,376.00
Receipts:						
Interest on investments	2,763.75				2,753.35	
Accrued interest	242.43					
Interest on deposits	181.10					
Annual dues—						
1909–10	10.00					
1911	60.00					
1912	585.00					
1913	5.00					
Increase of Bache fund to $56,000						3,714.00
Total	10,329.11			50,000.00	9,391.07	56,000.00
Disbursements:						
Warrants on funds					2,435.00	
General expenses	2,041.68				2.50	
Accrued interest	266.35					
Increase of Bache fund to $56,000					3,714.00	
Balances Dec. 31, 1912:						
Cash	811.08				664.57	14.55
Invested	7,210.00			50,000.00	2,575.00	55,985.45
Total	10,329.11			50,000.00	9,391.07	56,000.00
Mortgage notes paid						[1] 9,000.00
Investments made	2,047.50				510.00	9,132.95

[1] Include Porter loan transferred.

Account with individual funds Jan. 1, 1912, to Jan. 1, 1913—Continued.

	Comstock fund.		Draper fund.		Gibbs fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1912:						
Cash	$599.56		$1,029.41		$338.91	
Invested	1,100.00	$10,000.00	1,060.12	$10,000.00		$2,673.17
Receipts:						
Interest on investments	505.56		541.37		150.00	
Accrued interest	222.22					
Profit on sale of bonds		337.50				
Increase of Gibbs fund to $3,000						326.83
Total	2,427.34	10,337.50	2,630.90	10,000.00	488.91	3,000.00
Disbursements:						
Accrued interest	222.22					
Increase of Gibbs fund to $3,000					326.83	
Balances Dec. 31, 1912:						
Cash	205.12	87.50	1,095.90		162.08	
Invested	2,000.00	10,250.00	1,535.00	10,000.00		3,000.00
Total	2,427.34	10,337.50	2,630.90	10,000.00	488.91	3,000.00
Bonds sold		9,937.50				
Investments made		10,250.00				

	Gould fund.		Marsh fund.		Murray fund.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1912:						
Cash	$987.59		$112.11		$84.67	$35.00
Invested	2,932.50	$20,000.00		$1,250.00		5,965.00
Receipts:						
Interest on investments	1,078.32		62.50		291.38	
Increase of Marsh fund to $9,337.65				127.65		
Marsh bequest, second payment				8,000.00		
Total	4,998.41	20,000.00	174.61	9,377.65	376.05	6,000.00
Disbursements:						
Warrants on funds	500.00					
General expenses					50.00	
Increase of Marsh fund to $9,337.65			127.65			
Balances Dec. 31, 1912:						
Cash	893.41		46.96		326.05	35.00
Invested	3,605.00	20,000.00		9,377.65		5,965.00
Total	4,998.41	20,000.00	174.61	9,377.65	376.05	6,000.00
Mortgage notes paid		1,000.00				
Investments made	1,537.50	1,000.00		8,127.65		

Account with individual funds, Jan. 1, 1912, to Jan. 1, 1913—Continued.

	Smith fund.		Watson fund.		Semicentennial.	
	Income.	Capital.	Income.	Capital.	Income.	Capital.
Balance Jan. 1, 1912:						
Cash	$305.06	$15.00	$154.72	$340.00		
Invested	1,912.57	9,985.00	1,552.75	24,660.00		
Receipts:						
Interest on investments	521.45		1,182.08			
Semicentennial fund subscriptions					$1,835.00	
Total	2,739.08	10,000.00	2,889.55	25,000.00	1,835.00	
Disbursements:						
Warrants on funds	450.00		1,720.00			
General expenses	250.00				12.50	
Balances Dec. 31, 1912:						
Cash	506.58	15.00	1,169.55	270.00	1,822.50	
Invested	1,532.50	9,985.00		24.730.00		
Total	2,739.08	10,000.00	2,889.55	25,000.00	1,835.00	
Mortgage notes paid				2,250.00		
Investments made	500.00			2,040.00		

	Building fund.		Total.		
	Income.	Capital.	Income.	Capital.	
Balance Jan. 1, 1912:					
Cash	$418.89		$7,152.58	$1,310.00	$8,462.58
Invested		$7,000.00	18,555.83	192,899.17	211,455.00
Receipts					25,846.44
Interest on investments	350.00		10,199.76		
Accrued interest			464.65		
Interest on deposits			181.10		
Profit on sale of bonds				337.50	
Annual dues—					
1909-10			10.00		
1911			60.00		
1912			585.00		
1913			5.00		
Increase of Bache fund to $56,000				3,714.00	
Increase of Gibbs fund to $3,000				326.83	
Increase of Marsh fund to $9,337.65				127.65	
Marsh bequest, second payment				8,000.00	
Semicentennial subscriptions			1,835.00		
Total	768.89	7,000.00	39,048.92	206,715.15	245,764.07

Account with individual funds, Jan. 1, 1912, to Jan. 1, 1913—Continued.

	Building fund.		Total.		
	Income.	Capital.	Income.	Capital.	
Disbursements					$12,118.73
Warrants on funds			$5,105.00		
General expenses			2,356.68		
Accrued interest			488.57		
Increase of Bache fund to $56,000			3,714.00		
Increase of Gibbs fund to $3,000			326.83		
Increase of Marsh fund to $9,337.65			127.65		
Balances Dec. 31, 1912:					
Cash	$768.89		8,472.69	$422.05	8,894.74
Invested		$7,000.00	18,457.50	206,293.10	224,750.60
Total	768.89	7,000.00	39.048.92	206,715.15	245,764.07
Mortgage notes paid				12,250.00	
Bonds sold				9,937.50	
Investments made			4,595.00	30,550.60	

Respectfully submitted.

WHITMAN CROSS, *Treasurer.*

REPORT OF THE AUDITING COMMITTEE.

WASHINGTON, D. C., *January 15, 1913.*

We hereby certify that we have examined the securities and papers contained in the box of the National Academy of Sciences at the American Security & Trust Co.'s building, and have found them to correspond with the list furnished by the treasurer, and to differ from the list certified to under date of January 12, 1912, because of the sale and purchase of bonds and mortgage notes as shown by the books of the treasurer. We find that the coupons due in 1912 have been cut and are accounted for; also, that the coupons due January 1, 1913, have been detached and are accounted for by an appropriate entry in the pass book. We have accepted the certified statement of William L. Yaeger, public accountant, as to the correspondence between the vouchers, pass book, and accounts of the treasurer, and as to the balance shown by the books of the treasurer on December 31, 1912, and certify to its agreement with the balance shown by the report of the treasurer, by his check book, and by the American Security & Trust Co.

WILLIAM H. DALL, *Chairman*
F. W. CLARKE.
ARTHUR L. DAY.

APPENDICES.

APPENDIX A.

CONSTITUTION OF THE NATIONAL ACADEMY.

As amended and adopted April 17, 1872, and further amended April 20, 1875; April 21, 1881; April 19, 1882; April 18, 1883; April 19, 1888; April 18, 1895; April 20, 1899; April 17, 1902; April 18, 1906; November 20, 1906; April 17, 1907, November 20, 1907; April 20, 1911; April 16, 1912.

PREAMBLE.

Empowered by the act of incorporation enacted by Congress, and approved by the President of the United States on the 3d day of March, A. D. 1863, and in conformity with the amendment to said act approved July 14, 1870, the National Academy of Sciences adopts the following amended constitution and rules:

ARTICLE I.—OF MEMBERS.

SECTION 1. The academy shall consist of members, honorary members, and foreign associates. Members must be citizens of the United States.

SEC. 2. Members who, from age or inability to attend the meetings of the academy, wish to resign the duties of active membership, may, at their own request, be transferred to the roll of honorary members by a vote of the academy.

SEC. 3. The academy may elect 50 foreign associates.

SEC. 4. Honorary members and foreign associates shall have the privilege of attending the meetings and of reading and communicating papers to the academy, but shall take no part in its business, shall not be subject to its assessments, and shall be entitled to a copy of the publications of the academy.

ARTICLE II.—OF THE OFFICERS.

SECTION 1. The officers of the academy shall be a president, a vice president, a foreign secretary, a home secretary, and a treasurer, all of whom shall be elected for a term of six years, by a majority of votes present, at the first stated meeting after the expiration of the current terms, provided that existing officers retain their places until their successors are elected. In case of a vacancy, the election for six years shall be held in the same manner at the meeting when such vacancy occurs, or at the next stated meeting thereafter, as the academy may direct. A vacancy in the office of treasurer or home secretary may, however, be filled by appointment of the president of the academy until the next stated meeting of the academy.

SEC. 2. The officers of the academy, together with six members to be elected by the academy, shall constitute a council for the transaction of such business as may be assigned to them by the constitution or the academy.

SEC. 3. The president of the academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the academy and of the council; shall name all committees except such as are otherwise especially provided for; shall refer investigations required by the Government of the United States to members especially conversant with the subjects and report thereon to the academy at its meeting next ensuing; and, with the council, shall direct the general business of the academy.

It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy.

SEC. 4. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and council in cases of doubt, and reporting their action to the academy at one of the stated meetings in each year.

It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

The minutes of each meeting shall be duly engrossed before the next stated meeting under the direction of the home secretary.

SEC. 5. The treasurer shall attend to all receipts and disbursements of the academy, giving such bond and furnishing such vouchers as the council may require. He shall collect all dues from members and keep a set of books showing a full account of receipts and disbursements. He shall present a general report at the annual meeting. He shall be the custodian of the corporate seal of the academy.

ARTICLE III.—OF THE MEETINGS.

SECTION 1. The academy shall hold one stated meeting in each year, called the annual meeting, in the city of Washington, beginning on the third Tuesday in April, and another, called the autumn meeting, may be held at such place and time as the council shall determine.

Special business meetings of the academy may be called, by order of eight members of the council, at such place and time as may be designated in the call.

Special scientific meetings of the academy may be held at times and places to be designated by a majority of the council.

SEC. 2. The names of the members present at each session of a meeting shall be recorded in the minutes, and the members present at any session shall constitute a quorum for the transaction of business.

Sec. 3. Scientific sessions of the academy, unless otherwise ordered by a majority of the members present, shall be open to the public; sessions for the transaction of business shall be closed.

Sec. 4. Stated meetings of the council shall be held during the stated or special meetings of the academy. Special meetings of the council may be convened at the call of the president and two members of the council, or of four members of the council.

Sec. 5. No member who has not paid his dues shall take part in the business of the academy.

ARTICLE IV.—OF ELECTIONS AND RESIGNATIONS.

Section 1. All elections shall be by ballot, and each election shall be held separately unless otherwise ordered by this constitution.

Sec. 2. The time for holding an election of officers shall be fixed by the academy at least one day before the election is held.

Sec. 3. The election of the six members of the council shall be as follows:

At the annual meeting in April, 1907, six members of the council to be elected, of whom two shall serve for three years, two for two years, and two for one year, their respective terms to be determined by lot. Each year thereafter the terms of two members shall expire, and their successors, to serve for three years, shall be elected at the annual meeting in each year.

Sec. 4. The academy shall be divided by the council into standing committees representing the principal branches of scientific research. A member may be assigned to more than one of these committees. The president of the academy shall appoint, subject to the approval of the council, a member of each committee as its chairman, who shall be responsible for the work of the committee.

Nominations to membership in the academy shall be made in writing, approved by a majority of the members of the committee on the branch of research in which the person nominated is eminent, or by a majority of the council in case there is no committee on the subject. The nominations shall be sent to the home secretary by the chairman of the committee before January 1 of the year in which the election is to be held, and each nomination shall be accompanied by a list of the principal contributions of the nominee to science. This list shall be printed by the home secretary for distribution among the members of the academy.

Sec. 5. Election of members shall be held at the annual meeting in Washington in the following manner: There shall be two ballots—a preference ballot, which may be prepared either before or at the annual meeting and must be transmitted to the home secretary, and a final ballot to be taken at the meeting.

Preference ballot.—Each member may inscribe on a ballot not more than 10 names of nominees selected from the submitted list. A list of the nominees shall then be prepared, on which the names shall be entered in the order of the number of votes received by each. In case two or more nominees should have the same number of votes on this preference list, the order in which they shall be placed on the list shall be determined by a majority vote of those present.

Final ballot.—A vote shall first be taken on the nominee who appears first on the preference list, and he shall be declared elected if he receive two-thirds of the votes cast and not less than 20 votes in all, provided that the number of members of the academy be not 150 or over, in which case to be declared elected he must receive four-fifths of the votes cast and not less than 25 votes in all. A vote shall then be taken in similar manner on the nominee standing second on the preference list, and so on until all the nominees on the preference list shall have been acted on, or until 10 nominees shall have been elected.

Not more than 10 members shall be elected at one annual meeting.

Before and during elections a discussion of the merits of nominees will be in order.

The election of members may be suspended at any time by a majority vote of the members present.

SEC. 6. Every member elect shall accept his membership, personally or in writing, before the close of the next stated meeting after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

SEC. 7. The election of foreign associates shall be in the following manner:

Foreign associates may be nominated by the council and may be elected at the annual meeting by a two-thirds vote of the members present. Each member shall indicate on a ballot those names for which he votes, and those nominees whose names appear on two-thirds of the votes cast shall be declared elected. A list of those nominated shall be sent to all members of the academy with the notice of the meeting at which the election is to be held.

SEC. 8. A diploma, with the corporate seal of the academy and the signatures of the officers, shall be sent by the appropriate secretary to each member on his acceptance of his membership, and to foreign associates on their election.

SEC. 9. Resignations shall be addressed to the president and acted on by the academy.

SEC. 10. Whenever a member has not paid his dues for four successive years, the treasurer shall report the fact to the council, which may report the case to the academy with the recommendation that

the person thus in arrears be declared to have forfeited his membership. If this recommendation be approved by two-thirds of the members present, the said person shall no longer be a member of the academy and his name shall be dropped from the roll.

ARTICLE V.—OF SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SECTION 1. Communications on scientific subjects shall be read at scientific sessions of the academy, and papers by any member may be read by the author or by any other member, notice of the same having been previously given to the secretary.

SEC. 2. Any member of the academy may read a paper from a person who is not a member, and shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper.

Persons who are not members may read papers on invitation of the council or of the committee of arrangements.

SEC. 3. The academy may provide for the publication, under the direction of the council, of proceedings, memoirs, and reports.

SEC. 4. Propositions for investigations or reports by the academy shall be submitted to the council for approval, except those requested by the Government of the United States, which shall be acted on by the president, who will in such cases report their results to the Government as soon as obtained and to the academy at its next following stated meeting.

SEC. 5. The advice of the academy shall be at all times at the disposition of the Government upon any matter of science or art within its scope.

SEC. 6. An annual report to be presented to Congress shall be prepared by the president, and before its presentation submitted by him, first to the council and afterwards to the academy, at one of the stated meetings.

SEC. 7. Medals and prizes may be established, and the means of bestowing them accepted by the academy upon the recommendation of the council, by whom all the necessary arrangements for their establishment and award shall be made.

Bequests and trusts having for their object the advancement of science may also be accepted and administered by the academy.

ARTICLE VI.—OF THE PROPERTY OF THE ACADEMY.

SECTION 1. All investments shall be made by the treasurer in the corporate name of the academy with the approval of a finance committee of three members, to be appointed annually by the president, of which the treasurer shall be one. Investments shall be made in bonds of the United States, in State bonds, or bonds or notes secured by first mortgages on real estate, in investments legal for savings banks under the laws of Massachusetts or New York, or in other bonds recommended to the treasurer by the fiscal advisers of the academy.

The council shall, at its annual meeting in each year, designate one bank or trust company in Washington, D. C., and one in New York City, to act, when requested by the treasurer, as the fiscal advisers of the academy.

The treasurer shall have the authority, with the approval of the finance committee, to change any investment held by him in the corporate name of the academy.

SEC. 2. No contract shall be binding upon the academy which has not been first approved by the council.

SEC. 3. The assessments required for the support of the academy shall be fixed by the academy on the recommendation of the council.

ARTICLE VII.—OF ADDITIONS AND AMENDMENTS.

Additions and amendments to the constitution shall be made only at a stated meeting of the academy. Notice of a proposition for such a change must be given at a stated meeting, and shall be referred to the council, which may amend the proposition, and shall report thereon to the academy. Its report shall be considered by the academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated meeting, and if it receives two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

APPENDIX B.

RULES.

I. In the absence of any officer a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nominations.

II. On the first day of each stated session, immediately after calling the roll of members, a recording secretary shall be elected, by a plurality of members present, to assist the home secretary in keeping the records of the session.

III. The accounts of the treasurer shall, between January 1 and January 15 of each year, be audited by a committee of three members to be appointed by the president at the autumn meeting of the academy. The auditing committee may employ an expert accountant to examine the books of the treasurer. This committee shall inspect and verify the bonds, securities, and other property in the custody of the treasurer and shall compare the expenditures with the vouchers therefor. The annual report of the treasurer shall be published with that of the president to Congress. The reports of the treasurer and auditing committee shall be presented to the academy at the annual meeting.

IV. A committee of arrangements, consisting of five members, shall be appointed by the president for each stated session of the academy. This committee shall meet not less than two weeks previous to each session. It shall be in session during the meetings to make arrangements for the reception of the members, to arrange the business of each day, and, in general, to attend to all business and scientific arrangements.

It shall be the duty of the committee of arrangements to ascertain the length of time required for reading the several memoirs presented, and, when it appears advisable, to recommend a limit of time to be occupied in their discussion.

V. At the meetings the order of business shall be as follows:

1. Chair taken by the president, or, in his absence, by the vice president.
2. Roll of members called by home secretary.
3. Minutes of the preceding meeting read and approved.
4. Stated business.

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5. Reports of president, secretaries, treasurer, and committees.
6. Business from council.
7. Other business.
8. On the last day of the session the rough minutes of that day's proceedings are to be read for correction.

VI. The rules of order of the academy shall be those of the Senate of the United States, unless suspended by unanimous consent.

VII. Unless otherwise ordered by the academy, the scientific meetings at the April session shall be held in the afternoon, the mornings being reserved for business.

VIII. At each meeting the president shall announce the death of any members who may have died since the preceding meeting. As soon as practicable thereafter he shall designate a member to write—or with the approval of the president to secure from some other source—a biographical notice of each deceased member.

IX. The secretaries will receive memoirs at any time, and report the date of their reception at the next session; but no memoir shall be published unless it has been read or presented by title before the academy.

Before publication all memoirs must be referred to the committee on publication, who may, if they deem best, refer any memoir to a special committee appointed by the president to determine whether the same should be published by the academy.

X. Memoirs shall date, in the records of the academy, from the date of their presentation to the academy, and the order of their presentation shall be so arranged by the secretary that, so far as may be convenient, those upon kindred topics shall follow one another.

XI. Papers from persons not members read before the academy and intended for publication shall be referred at the meeting at which they are read to a committee of members competent to judge whether the paper is worthy of publication. Such committee shall report to the academy as early as practicable, and not later than the next stated session.

XII. The annual report of the academy may be accompanied by a memorial to Congress in regard to such investigations and other subjects as may be deemed advisable, recommending appropriations therefor when necessary.

XIII. The proper secretary shall acknowledge all donations made to the academy, and shall report them at the next stated session.

XIV. The books, apparatus, archives, and other collections of the academy shall be deposited in some safe place in the city of Washington. A list of the articles so deposited shall be kept by the home secretary, who is authorized to employ a clerk to take charge of them.

XV. A stamp corresponding to the corporate seal of the academy shall be kept by the secretaries, who shall be responsible for the due marking of all books and other objects to which it is applicable.

Labels or other proper marks of similar device shall be placed upon objects not admitting of the stamp.

XVI. The treasurer is authorized to defray, when approved by the president, all the proper expenses of committees appointed to make scientific investigations at the request of departments of the Government, and in each case to look to the department requesting the investigation for reimbursement to the academy.

XVII. Nominations for membership should state the full name, residence, the official position, and the special scientific studies of the candidate. A form of nomination shall be prepared by the home secretary.

XVIII. Ballots for election of members may be sent by sealing them up in a blank envelope, and inclosing this in another, across the back of which is written the name of the sender, and which is addressed to the home secretary; such envelopes will be opened only by the tellers.

XIX. All discussions as to the claims and qualifications of nominees at meetings of the academy will be held strictly confidential, and remarks and criticisms then made may be communicated to no person who was not a member of the academy at the time of the discussion.

XX. Any rule of the academy may be amended, suspended, or repealed on the written motion of any two members, signed by them, and presented at a stated session of the academy, provided the same shall be approved by a majority of the members present.

XXI. The fiscal year of the academy shall end on December 31 of each year.

XXII. The annual reports of the committees on research funds shall, so far as the academy has authority to determine their form, give a current number to each award, stating the name, position, and address of the recipient, the subject of research for which the award is made, and the sum awarded; and in later annual reports the status of the work accomplished under each award previously made shall be announced, until the research is completed, when announcement of its completion and, if published, the title and place of publication shall be stated, and the record of the award shall be reported as closed.

By a resolution adopted January 12, 1864, the president is ex officio a member of all government committees of the academy.

APPENDIX C.

ORGANIZATION OF THE ACADEMY, 1912–1913.

	Expiration of term.
Remsen, Ira, *President*	April, 1913
Walcott, C. D., *Vice President*	April, 1913
Hale, George E., *Foreign Secretary*	April, 1916
Hague, Arnold, *Home Secretary*	April, 1913
Cross, Whitman, *Treasurer*	April, 1917

ADDITIONAL MEMBERS OF COUNCIL.

1910–1913.

Osborn, H. F.
Chittenden, R. H.

1911–1914.

Conklin, E. G.
Noyes, A. A.

1912–1915.

Councilman, W. T.
Woodward, R. S.

COMMITTEES OF THE ACADEMY.

1. MATHEMATICS AND ASTRONOMY.

Abbe, C.
Barnard, E. E.
Bôcher, Maxime.
Bolza, Oskar.
Campbell, W. W.
Chandler, S. C.
Comstock, G. C., *Chairman.*
Elkin, W. L.
Frost, E. B.
Hale, G. E.
Hill, G. W.
Holden, E. S.
Moore, E. H.
Moulton, F. R.
Osgood, W. F.
Peirce, C. S.
Pickering, E. C.
Story, W. E.
Van Vleck, E. B.
Webster, A. G.
Woodward, R. S.

2. PHYSICS AND ENGINEERING.

Abbe, C.
Abbot, H. L.
Ames, J. S.
Barus, C.
Bell, A. G.
Crew, Henry.
Hall, Edwin H.
Hastings, C. S.
Hayford, J. F.
Mendenhall, T. C.
Michelson, A. A.
Morley, E. W.
Nichols, E. F.
Nichols, E. L.
Peirce, B. O.
Pickering, E. C.
Pupin, M. I.
Thomson, Elihu.
Trowbridge, J.
Webster, A. G.
Wood, Robert W.
Woodward, R. S., *Chairman.*
Wright, A. W.

3. CHEMISTRY.

Boltwood, B. B.
Chandler, C. F.
Chittenden, R. H.
Clarke, F. W.
Crafts, J. M.
Gooch, F. A.
Hilgard, E. W.
Hillebrand, W. F.
Jackson, C. L.
Michael, A.
Morley, E. W.
Morse, H. N.
Nef, John U.
Noyes, A. A., *Chairman.*
Noyes, W. A.
Osborne, T. B.
Remsen, Ira.
Richards, T. W.
Smith, E. F.
Stieglitz, J. O.
Wells, H. L.
Wheeler, H. L.

4. GEOLOGY AND PALÆONTOLOGY.

Becker, G. F.
Branner, J. C.
Chamberlin, T. C.
Clark, W. B.
Clarke, J. M.
Cross, Whitman.
Dall, W. H.
Dana, E. S.
Davis, W. M.
Day, Arthur L.
Gilbert, G. K.
Hague, Arnold, *Chairman.*
Iddings, J. P.
Kemp, J. F.
Lindgren, Waldemar.
Osborn, H. F.
Pumpelly, R.
Reid, H. Fielding.
Schuchert, Chas.
Scott, W. B.
Van Hise, C. R.
Walcott, C. D.
White, David.

5. BOTANY.

Campbell, D. H.
Coulter, J. M.
Farlow, W. G.
Goodale, G. L.
Harper, R. A.
Sargent, C. S.
Thaxter, Roland.
Trelease, Wm., *Chairman.*

6. ZOOLOGY AND ANIMAL MORPHOLOGY.

Allen, J. A.
Conklin, E. G., *Chairman.*
Dall, W. H.
Davenport, C. B.
Gill, T. N.
Mall, F. P.
Mark, E. L.
Merriam, C. H.
Minot, C. S.
Morgan, T. H.
Morse, E. S.
Osborn, H. F.
Verrill, A. E.
Walcott, C. D.
Wheeler, W. M.
Wilson, E. B.

7. PHYSIOLOGY AND PATHOLOGY.

Abel, John Jacob.
Billings, J. S.
Chittenden, R. H., *Chairman.*
Councilman, W. T.
Flexner, Simon.
Howell, W. H.
Loeb, Jacques.
Mall, F. P.
Meltzer, S. J.
Minot, C. S.
Mitchell, S. W.
Prudden, T. M.
Smith, Theobald.
Welch, W. H.
Wood, H. C.

8. ANTHROPOLOGY AND PSYCHOLOGY.

Boas, Franz.
Cattell, J. McK.
Dewey, John.
Holmes, W. H.. *Chairman.*
Merriam, C. Hart.
Morse, E. S.
Peirce, C. S.
Putnam, F. W.
Royce, Josiah.

ON WEIGHTS, MEASURES, AND COINAGE.

Mendenhall, T. C., *Chairman.*
Michelson, A. A.
Webster, A. G.
Morley, E. W.
Peirce, C. S.
Woodward, R. S.

ON PUBLICATION.

The President.
The Home Secretary.
Walcott, C. D.

ON SOLAR RESEARCH.

Hale, George E., *Chairman.*
Michelson, A. A.
Comstock, G. C.
Campbell, W. W.
Nichols, E. L

TRUST FUNDS.

BOARD OF DIRECTION OF THE BACHE FUND.

[1879, residual estate, $47,500.]

For researches in physical and natural science.

Minot, C. S., *Chairman*. Remsen, Ira. Frost, E. B.

BOARD OF TRUSTEES OF THE WATSON FUND.

[1883, residual estate, $18,666.88.]

For the promotion of astronomical research.

Pickering, E. C., *Chairman*. Elkin, W. L. Frost, E. B.

THE HENRY DRAPER FUND.

[1885, $6,000.]

Award of medal for important discoveries in astronomy.

Hale, George E., *Chairman*. Trowbridge, John. Wright, A. W.
Campbell, W. W. Michelson, A. A.

THE J. LAWRENCE SMITH FUND.

[1885, $8,000.]

For the investigation of meteoric bodies.

Morley, E. W., *Chairman*. Dana, E. S. Hague, Arnold.
Pumpelly, R. Remsen, Ira.

THE BENJAMIN APTHORP GOULD FUND.

[1897, $20,000.]

For researches in astronomy.

Moulton, F. R., *Chairman*. Chandler, S. C. Hill, G. W.

THE BARNARD MEDAL.[1]

For meritorious service to science.

Woodward, R. S., *Chairman*. Campbell, W. W. Noyes, A. A.
Nichols, E. F. Richards, T. W.

THE WOLCOTT GIBBS FUND.

[1893, $2,673.17.]

For chemical research.

Jackson, C. L., *Chairman*. Remsen, Ira. Smith, Edgar F.

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[1] Every five years the committee recommends the person whom they consider most deserving of the medal, and upon the approval of the academy the name of the nominee is forwarded to the trustees of Columbia College, who administer the Barnard medal fund.

THE COMSTOCK TRUST FUND.

[1907, $10,000.]

For researches in electricity, magnetism, and radiant energy.

NICHOLS, E. L., *Chairman*. NOYES, ARTHUR A. THOMSON, ELIHU.
CREW, HENRY. WEBSTER, A. G.

THE MARSH TRUST FUND.

[1912, $9,377.65]

For promoting original research in the natural sciences.

AGASSIZ FUND.

[1910, $50,000.]

For the general uses of the academy.

MURRAY FUND.

[1911, $6,000.]

For original contributions to the science of oceanography.

HAGUE, ARNOLD, *Chairman*. DALL, WILLIAM H. GILL, THEODORE N.

JOSEPH HENRY FUND.

To assist meritorious investigators, especially in the direction of original research.

The sum of $40,000 was contributed by Fairman Rogers, Joseph Patterson, George W. Childs, and others as an expression of their respect and esteem for Prof. Joseph Henry. This amount was deposited with the Pennsylvania Co. for the Insurance of Lives and Granting Annuities in Trust, with authorization to collect the income thereon and to pay over the same to Prof. Joseph Henry during his natural life, and after his death to his wife and daughters, and after the death of the last survivor to "deliver the said fund and the securities in which it shall then be invested to the National Academy of Sciences, to be thenceforward forever held in trust under the name and title of the 'Joseph Henry fund.'"

MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES, JAN. 27, 1913.

		Date of election.
ABBE, CLEVELAND	*U. S. Weather Bureau, Washington, D. C.*	1879
ABBOT, HENRY L., U. S. A.	*23 Berkeley St., Cambridge, Mass.*	1872
ABEL, JOHN JACOB	*Johns Hopkins University, Baltimore, Md.*	1912
ALLEN, J. ASAPH	*American Museum of Natural History, N. Y. City.*	1876
AMES, JOSEPH S.	*Johns Hopkins University, Baltimore, Md.*	1909
BARNARD, E. E.	*Yerkes Observatory, Williams Bay, Wis.*	1911
BARUS, CARL	*Brown University, Providence, R. I.*	1892
BECKER, GEORGE F.	*U. S. Geological Survey, Washington, D. C.*	1901
BELL, A. GRAHAM	*1331 Connecticut Ave., Washington, D. C.*	1883
BILLINGS, JOHN S., U. S. A.	*32 E. Thirty-first St., New York City.*	1883
BOAS, FRANZ	*123 W. Eighty-second St., New York City.*	1900
BÔCHER, MAXIME	*Harvard University, Cambridge, Mass.*	1909
BOLTWOOD, B. B.	*Yale University, New Haven, Conn.*	1911
BOLZA, OSKAR	*Marienstrasse 7, Freiburg, Germany.*	1909
BRANNER, JOHN C.	*Stanford University, California.*	1905

		Date of election.
Campbell, D. H.	*Stanford University, California.*	1910
Campbell, William W.	*Lick Observatory, Mount Hamilton, California.*	1902
Cattell, James McK.	*Garrison, N. Y.*	1901
Chamberlin, Thomas C.	*University of Chicago, Chicago, Ill.*	1903
Chandler, Charles F.	*Columbia University, New York City.*	1874
Chandler, Seth C.	*Box 216, Wellesley Hills, Mass.*	1888
Chittenden, Russell H.	*Sheffield Scientific School, New Haven, Conn.*	1890
Clark, W. B.	*Johns Hopkins University, Baltimore, Md.*	1908
Clarke, F. W.	*U. S. Geological Survey, Washington, D. C.*	1909
Clarke, J. M.	*State Hall, Albany, N. Y.*	1909
Comstock, George C.	*Washburn Observatory, Madison, Wis.*	1899
Conklin, E. G.	*Princeton, N. J.*	1908
Coulter, J. M.	*University of Chicago, Chicago, Ill.*	1909
Councilman, Wm. T.	*Harvard Medical School, Boston, Mass.*	1904
Crafts, James M.	*59 Marlborough St., Boston, Mass.*	1872
Crew, Henry	*Northwestern University, Evanston, Ill.*	1909
Cross, Whitman	*U. S. Geological Survey, Washington, D. C.*	1908
Dall, William H.	*Smithsonian Institution, Washington, D. C.*	1897
Dana, Edward S.	*Yale University, New Haven, Conn.*	1884
Davenport, Charles B.	*Cold Spring Harbor, N. Y.*	1912
Davis, William Morris	*17 Francis Ave., Cambridge, Mass.*	1904
Day, Arthur L.	*Geophysical Laboratory, Washington, D. C.*	1911
Dewey, John	*Columbia University, New York City.*	1910
Elkin, William L.	*Yale University Observatory, New Haven, Conn.*	1895
Farlow, W. G.	*Harvard University, Cambridge, Mass.*	1879
Flexner, Simon	*Rockefeller Institute, New York City.*	1908
Frost, Edwin B.	*Yerkes Observatory, Williams Bay, Wis.*	1908
Gilbert, Grove K.	*U. S. Geological Survey, Washington, D. C.*	1883
Gill, Theodore N.	*Smithsonian Institution, Washington, D. C.*	1873
Gooch, Frank A.	*Yale University, New Haven, Conn.*	1897
Goodale, George L.	*Harvard University, Cambridge, Mass.*	1890
Hague, Arnold	*U. S. Geological Survey, Washington, D. C.*	1885
Hale, George E.	*Solar Observatory office, Pasadena, Cal.*	1902
Hall, Edwin H.	*Harvard University, Cambridge, Mass.*	1911
Harper, R. A.	*Columbia University, New York City.*	1911
Hastings, Charles S.	*Yale University, New Haven, Conn.*	1889
Hayford, John F.	*Northwestern University, Evanston, Ill.*	1911
Hilgard, Eugene W.	*University of California, Berkeley, Cal.*	1872
Hill, George W.	*West Nyak, N. Y.*	1874
Hillebrand, William F.	*Bureau of Standards, Washington, D. C.*	1908
Holden, Edward S.	*U. S. Military Academy, West Point, N. Y.*	1885
Holmes, William H.	*U. S. National Museum, Washington, D. C.*	1905
Howell, William H.	*Johns Hopkins University, Baltimore, Md.*	1905
Iddings, Joseph P.	*Brinklow, Md.*	1907
Jackson, Charles L.	*6 Boylston Hall, Cambridge, Mass.*	1883
Kemp, James F.	*Columbia University, New York City.*	1911
Lindgren, Waldemar	*U. S. Geological Survey, Washington, D. C.*	1909
Loeb, Jacques	*Rockefeller Institute, New York City.*	1910
Mall, Franklin P.	*Johns Hopkins University, Baltimore, Md.*	1907
Mark, Edward L.	*109 Irving Street, Cambridge, Mass.*	1903
Meltzer, Samuel James	*Rockefeller Institute, New York City.*	1912
Mendenhall, Thomas C.	*329 North Chestnut Street, Ravenna, Ohio.*	1887

		Date of election.
Merriam, C. Hart	*1919 Sixteenth Street, Washington, D. C.*	1902
Michael, Arthur	*219 Parker Street, Newton Center, Mass.*	1889
Michelson, Albert A.	*University of Chicago, Chicago, Ill.*	1888
Minot, Charles S.	*Harvard Medical School, Boston, Mass.*	1897
Mitchell, S. Weir	*1524 Walnut Street, Philadelphia, Pa.*	1865
Moore, Eliakim H.	*University of Chicago, Chicago, Ill.*	1901
Morgan, T. H.	*Columbia University, New York City.*	1909
Morley, Edward W.	*West Hartford, Conn.*	1897
Morse, Edward S.	*Salem, Mass.*	1876
Morse, Harmon N.	*Johns Hopkins University, Baltimore, Md.*	1907
Moulton, F. R.	*University of Chicago, Chicago, Ill.*	1910
Nef, John Ulric	*University of Chicago, Chicago, Ill.*	1904
Nichols, Edward L.	*Cornell University, Ithaca, N. Y.*	1901
Nichols, Ernest F.	*Dartmouth College, Hanover, N. H.*	1908
Noyes, Arthur A.	*Massachusetts Institute of Technology, Boston, Mass.*	1905
Noyes, William A.	*University of Illinois, Urbana, Ill.*	1910
Osborn, H. F.	*American Museum of Natural History, New York City.*	1900
Osborne, T. B.	*Agricultural Experiment Station, New Haven, Conn.*	1910
Osgood, William Fogg	*Harvard University, Cambridge, Mass.*	1904
Peirce, Benjamin O.	*Harvard University, Cambridge, Mass.*	1906
Peirce, Charles S.	*Milford, Pa.*	1876
Pickering, Edward C.	*Harvard College Observatory, Cambridge, Mass.*	1873
Prudden, T. Mitchell	*Columbia University, New York City.*	1901
Pumpelly, Raphael	*Gibbs Ave., Newport, R. I.*	1872
Pupin, Michael I.	*Columbia University, New York City.*	1905
Putnam, Frederick W.	*Peabody Museum, Cambridge, Mass.*	1885
Reid, H. Fielding	*Johns Hopkins University, Baltimore, Md.*	1912
Remsen, Ira	*Johns Hopkins University, Baltimore, Md.*	1882
Richards, Theodore W.	*Harvard University, Cambridge, Mass.*	1899
Royce, Josiah	*Harvard University, Cambridge, Mass.*	1906
Sargent, Charles S.	*Arnold Arboretum, Jamaica Plain, Mass.*	1895
Schuchert, Charles	*Yale University, New Haven, Conn.*	1910
Scott, William B.	*Princeton University, Princeton, N. J.*	1906
Smith, Edgar F.	*University of Pennsylvania, Philadelphia, Pa.*	1899
Smith, Theobald	*Harvard Medical School, Boston, Mass.*	1908
Stieglitz, J. O.	*University of Chicago, Chicago, Ill.*	1911
Story, William E.	*Clark University, Worcester, Mass.*	1908
Thaxter, Roland	*Harvard University, Cambridge, Mass.*	1912
Thomson, Elihu	*Swampscott, Mass.*	1907
Trelease, Wm.	*Missouri Botanical Garden, St. Louis, Mo.*	1902
Trowbridge, John	*Harvard University, Cambridge, Mass.*	1878
Van Hise, C. R.	*University of Wisconsin, Madison, Wis.*	1902
Van Vleck, E. B.	*University of Wisconsin, Madison, Wis.*	1911
Verrill, A. E.	*Yale University, New Haven, Conn.*	1872
Walcott, Charles D.	*Smithsonian Institution, Washington, D. C.*	1896
Webster, Arthur G.	*Clark University, Worcester, Mass.*	1903
Welch, William H.	*807 St. Paul St., Baltimore, Md.*	1895
Wells, Horace L.	*Yale University, New Haven, Conn.*	1903
Wheeler, Henry L.	*Sheffield Scientific School, New Haven, Conn.*	1909
Wheeler, William M.	*Harvard University, Cambridge, Mass.*	1912
White, David	*U. S. Geological Survey, Washington, D. C.*	1912
Wilson, Edmund B.	*Columbia University, New York City.*	1899

		Date of election.
Wood, Horatio C.	*4107 Chester Ave., Philadelphia, Pa.*	1879
Wood, Robert W.	*Johns Hopkins University, Baltimore, Md.*	1912
Woodward, Robert S.	*Carnegie Institution, Washington, D. C.*	1896
Wright, Arthur W.	*Yale University, New Haven, Conn.*	1881

HONORARY MEMBER.

Smith, Sidney I.	*Yale University, New Haven, Conn.*	1884

FOREIGN ASSOCIATES.

Arrhenius, S. A.	*Nobelinstitut, Stockholm.*	1908
Auwers, G. F. J. Arthur	*Bellevue Str. 55, Grosslichterfelde W., Berlin.*	1883
Backlund, Oskar	*Astron. Sternwarte, Pulkowa.*	1903
Baeyer, Adolph Ritter von	*Universität, Munich.*	1898
Barrois, Charles	*Université, Lille.*	1908
Brøgger, W. C.	*Universitet, Christiania.*	1903
Dewar, Sir James	*University, Cambridge.*	1907
Ehrlich, Paul	*Königl. Inst. für Exper. Therapie, Frankfurt a. Main.*	1904
Fischer, Emil	*Chemisches Inst. der Universität, Berlin,*	1904
Forsyth, A. R.	*Trinity College, Cambridge.*	1907
Geikie, Sir Archibald	*Haslemere, Surrey.*	1901
Gill, Sir David	*34 De Vere Gardens, Kensington, London, W.*	1898
Groth, Paul von	*Universität, Munich.*	1905
Hilbert, David	*Universität, Göttingen.*	1907
Kapteyn, John C.	*Rijks Universiteit, Groningen.*	1907
Klein, Felix	*Universität, Göttingen.*	1898
Kronecker, Hugo	*Kantonale Universität, Berne.*	1901
Lankester, E. Ray	*South Kensington, London.*	1903
Larmor, Sir Joseph	*St. Johns College, Cambridge.*	1908
Lorentz, Hendrik Anton	*Rijks Universiteit, Leiden.*	1906
Murray, Sir John	*Edinburgh, Scotland.*	1912
Ostwald, Wilhelm	*Grossbothen, bei Leipzig.*	1906
Pavlov, Ivan Petrovitch	*Kais. Inst. für Exper. Med., St. Petersburg.*	1908
Penck, Albrecht	*Universität, Berlin.*	1909
Pfeffer, Wilhelm	*Bot. Inst. der Universität, Leipzig.*	1903
Picard, Charles Émile	*Université, Paris.*	1903
Ramsay, Sir William	*University College, London.*	1904
Rayleigh, Lord	*University, Cambridge.*	1898
Retzius, Gustav	*Högskolan, Stockholm.*	1909
Rosenbusch, H.	*Universität, Heidelberg.*	1904
Rutherford, Ernest	*University, Manchester.*	1911
Seeliger, Hugo Ritter von	*Universität, Munich.*	1908
Suess, Edouard	*Universität, Vienna.*	1898
Thomson, Sir Joseph	*University, Cambridge.*	1903
Volterra, Vito	*Università, Rome.*	1911
Vries, Hugo de	*Universiteit, Amsterdam.*	1904
Waldeyer, Wilhelm	*Universität, Berlin.*	1909
Wundt, Wilhelm	*Universität, Leipzig.*	1909

DECEASED MEMBERS.

	Date of election.	Date of death.
Agassiz, Alexander	1866	Mar. 27, 1910
Agassiz, Louis	(1)	Dec. 14, 1873
Alexander, J. H.	(1)	Mar. 2, 1867
Alexander, Stephen	(1)	June 25, 1883
Bache, Alexander Dallas	(1)	Feb. 14, 1867
Baird, Spencer F	1864	Aug. 19, 1887
Barker, George F.[2]	1876	May 24, 1910
Barnard, F. A. P.[2]	(1)	Apr. 27, 1889
Barnard, J. G	(1)	May 14, 1882
Bartlett, W. H. C.	(1)	Feb. 11, 1893
Beecher, Charles Emerson	1899	Feb. 14, 1904
Boss, Lewis[2]	1889	Oct. 5, 1912
Bowditch, Henry P.[2]	1887	Mar. 13, 1911
Brewer, William H.[2]	1880	Nov. 2, 1910
Brooks, William Keith	1884	Nov. 12, 1908
Brown-Sequard, Charles E	1868	Apr. 2, 1894
Brush, George Jarvis[2]	1868	Feb. 6, 1912
Casey, Thomas L	1890	Mar. 25, 1896
Caswell, Alexis	(1)	Jan. 8, 1887
Chauvenet, William	(1)	Dec. 13, 1870
Clarke, Henry James	1872	July 1, 1873
Coffin, James	1869	Jan. 6, 1873
Coffin, J. H. C.[2]	(1)	Jan. 8, 1890
Comstock, Cyrus B	1884	May 29, 1910
Cook, George H	1887	Sept. 22, 1889
Cooke, Josiah P	1872	Sept. 3, 1894
Cope, Edward D.[2]	1872	Apr. 12, 1897
Coues, Elliott	1877	Dec. 25, 1899
Dalton, J. C	1864	Feb. 2, 1889
Dana, James D.[2]	(1)	Apr. 14, 1895
Davidson, George[2]	1874	Dec. 2, 1911
Davis, Charles H	(1)	Feb. 14, 1877
Draper, Henry	1877	Nov. 20, 1882
Draper, John W	1877	Jan. 4, 1882
Dutton, C. E.[2]	1884	Jan. 4, 1912
Eads, James B	1872	Mar. 8, 1887
Emmons, Samuel F	1892	Mar. 28, 1911
Englemann, George	(1)	Feb. 4, 1884
Ferrel, William	1868	Sept. 18, 1891
Frazer, John Fries	(1)	Oct. 12, 1872
Gabb, William M	1876	May 30, 1878
Genth, F. A	1872	Feb. 2, 1893
Gibbs, Josiah Willard	1879	Apr. 28, 1903
Gibbs, Wolcott	(1)	Dec. 9, 1908
Gilliss, James Melville	(1)	Feb. 9, 1865
Goode, G. Brown	1888	Sept. 6, 1896
Gould, Augustus A	(1)	Sept. 15, 1866
Gould, Benjamin A.[2]	(1)	Nov. 27, 1896
Gray, Asa	(1)	Jan. 30, 1888
Guyot, Arnold	(1)	Feb. 8, 1884
Hadley, James	1864	Aug. 1, 1872
Haldeman, S. S	1876	Sept. 20, 1880
Hall, Asaph	1875	Nov. 22, 1907

[1] Charter members, Mar. 3, 1863.

[2] Biographical notices have not been presented.

Deceased members—Continued.

	Date of election.	Date of death.
HALL, JAMES[1]	(2)	Aug. 8, 1898
HAYDEN, F. V	1873	Dec. 22, 1887
HENRY, JOSEPH	(2)	May 13, 1878
HILGARD, JULIUS E	(2)	May 8, 1891
HILL, HENRY B	1883	Apr. 6, 1903
HITCHCOCK, EDWARD	(2)	Feb. 27, 1864
HOLBROOK, J. E	1868	Sept. 8, 1871
HUBBARD, J. S	(2)	Aug. 16, 1863
HUMPHREYS, A. A	(2)	Nov. 28, 1883
HUNT, T. STERRY[1]	1873	Feb. 12, 1892
HYATT, ALPHEUS	1875	Jan. 16, 1902
JOHNSON, S. W	1866	July 21, 1909
KEELER, J. E	1900	Aug. 12, 1900
KING, CLARENCE	1876	Dec. 24, 1901
KIRKLAND, JARED P	1865	Dec. 10, 1877
LANE, J. HOMER	1872	May 3, 1880
LANGLEY, SAMUEL P	1876	Feb. 27, 1906
LE CONTE, JOHN	1878	Apr. 29, 1891
LE CONTE, JOHN L	(2)	Nov. 15, 1883
LE CONTE, JOSEPH	1875	July 6, 1901
LEA, MATTHEW CAREY	1892	Mar. 15, 1897
LEIDY, JOSEPH	(2)	Apr. 30, 1891
LESLEY, J. PETER[1]	(2)	June 3, 1903
LESQUEREUX, LEO	1864	Oct. 25, 1889
LONGSTRETH, MIERS F.[1]	(2)	Dec. 27, 1891
LOOMIS, ELIAS	1873	Aug. 16, 1889
LOVERING, JOSEPH	1873	Jan. 18, 1892
LYMAN, THEODORE	1872	Sept. 10, 1897
MAHAN, D. H	(2)	Sept. 16, 1871
MARSH, G. P	1866	July 23, 1882
MARSH, O. C.[1]	1874	Mar. 18, 1899
MAYER, ALFRED M.[1]	1872	July 13, 1897
MAYO-SMITH, RICHMOND[1]	1890	Nov. 11, 1901
MEEK, F. B	1869	Dec. 21, 1877
MEIGS, M. C	1865	Jan. 2, 1892
MITCHELL, HENRY[1]	1885	Dec. 1, 1902
MORGAN, LEWIS H	1875	Dec. 14, 1881
MORTON, HENRY[1]	1874	May 9, 1902
NEWBERRY, J. S	(2)	Dec. 7, 1892
NEWCOMB, SIMON[1]	1869	July 11, 1909
NEWTON, H. A	(2)	Aug. 1, 1896
NEWTON, JOHN	1876	May 1, 1895
NORTON, WILLIAM A	1873	Sept. 21, 1883
OLIVER, JAMES E	1872	Mar. 27, 1895
PACKARD, A. S.[1]	1872	Feb. 14, 1905
PENFIELD, SAMUEL L	1900	Aug. 13, 1906
PETERS, C. H. F.[1]	1876	July 18, 1890
POURTALES, L. F	1873	July 19, 1880
POWELL, JOHN W.[1]	1880	Sept. 23, 1902
RODGERS, JOHN	(2)	May 5, 1882
ROGERS, FAIRMAN	(2)	Aug. 23, 1900
ROGERS, ROBERT E	(2)	Sept. 7, 1884

[1] Biographical notices have not been presented.

(2) Charter members, Mar. 3, 1863.

Deceased members—Continued.

	Date of election.	Date of death.
Rogers, Wm. A.	1885	Mar. 1, 1898
Rogers, William B.	(1)	May 30, 1882
Rood, Ogden N.	1885	Nov. 12, 1902
Rowland, Henry A.	1881	Apr. 16, 1901
Rutherford, Lewis M.	(1)	May 30, 1892
Saxton, Joseph	(1)	Oct. 26, 1873
Schott, Charles A.[2]	1872	July 31, 1901
Scudder, Samuel H.[2]	....	May 17, 1911
Sellers, William [2]	1873	Jan. 24, 1905
Silliman, Benj., Sr.	(1)	Nov. 24, 1864
Silliman, Benj., Jr.	(1)	Jan. 14, 1885
Smith, J. Lawrence	1872	Oct. 12, 1883
Stimpson, William [2]	1868	May 26, 1873
Strong, Theodore	(1)	Feb. 1, 1869
Sullivant, W. S.	1873	Apr. 30, 1882
Torrey, John	(1)	Mar. 10, 1873
Totten, J. G.	(1)	Apr. 22, 1864
Trowbridge, William P.	1872	Aug. 12, 1892
Trumbull, James H.	1872	Aug. 5, 1897
Tuckerman, Edward	1868	Mar. 15, 1886
Walker, Francis A.	1878	Jan. 5, 1897
Warren, G. K.	1876	Aug. 8, 1882
Watson, James C.	1868	Nov. 23, 1880
Watson, Sereno	1889	Mar. 9, 1892
White, Charles A.	1889	June 29, 1910
Whitman, C. O.	1895	Dec. 6, 1910
Winlock, Joseph	(1)	June 11, 1875
Woodward, J. J.	1873	Aug. 17, 1884
Worthen, A. H.	1872	May 6, 1888
Wyman, Jeffries	(1)	Sept. 4, 1874
Young, Charles A.	1872	Jan. 3, 1908

[1] Charter members, Mar. 3, 1863.

[2] Biographical notices have not been presented.

DECEASED FOREIGN ASSOCIATES.

Adams, J. C.
Airy, Sir George B.
Argelander, F. W. A.
Baer, Karl Ernest von.
Barrande, Joachim.
Beaumont, L. Élie de.
Becquerel, Henri.
Berthelot, M. P. E.
Bertrand, J. L. F.
Boltzmann, Ludwig.
Bornet, Edouard.
Boussingault, J. B. J. D.
Braun, Alexander.
Brewster, Sir David.
Bunsen, Robert W.
Burmeister, C. H. C.
Candolle, Alphonse de.
Cayley, Arthur.
Chasles, Michel.
Chevreul, M. E.
Clausius, Rudolph.
Cornu, Alfred.
Darwin, Sir George Howard.
Dove, H. W.
Dumas, J. B.
Farraday, Michael.
Gegenbaur, Karl.
Gyldén, Hugo.
Hamilton, Sir William Rowan.
Helmholtz, Baron H. von.
Hoff, J. H. van't.
Hofmann, A. W.
Hooker, Sir Joseph D.
Huggins, Sir William.
Huxley, T. H.
Ibañez, Carlos.
Janssen, J.
Joule, James P.
Kekulé, August.
Kelvin, Lord.
Kirchoff, G. R.
Koch, Robert.
Kohlrausch, Friedrich.
Kölliker, Albert von.
Lacaze-Duthiers, Henri de.
Leuckart, Rudolph.
Lie, Sophus.
Liebig, Justus von.
Loewy, Maurice.
Ludwig, K. F. W.
Marey, E. J.
Mendeléeff, D. I.
Milne-Edwards, Henri.
Moissan, Henri.
Murchison, Sir Roderick I.
Oppolzer, Theodore von.
Owen, Sir Richard.
Pasteur, Louis.
Peters, C. A. F.
Plana, G. A. A.
Poincaré, Jules Henri.
Rammelsberg, C. F.
Regnault, Victor.
Reymond, Emil Du Bois.
Richthofen, F. von.
Sachs, Julius von.
Schiaparelli, Giovanni.
Stas, Jean Servais.
Stokes, Sir George G.
Strasburger, Edouard.
Struve, Otto von.
Sylvester, J. J.
Tisserand, F. F.
Virchow, Rudolph von.
Vogel, H. C.
Weierstrass, Karl.
Wöhler, Friedrich.
Würtz, Adolph.
Zirkel, Ferdinand.
Zittel, K. A. R. von.

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Nationl Academy of Sciences.
Report.

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